Systems Manual

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1.1.1 The Value of Extracting Carpet and Pad

Extraction Tools

Stationary Tool - Stationary because you have to move it yourself, this tool is designed for subsurface extraction. That means that it will extract water from the pad and the surface of the sub flooring but not from the carpet. You must follow the stationary tool with a light wand to extract the water left in the carpet. These are best attached to a truck mounted vacuum system and a two inch vacuum line.

Ride-On Tool - This tool uses your weight to compress the pad and extract both carpet and pad. Some tools have their own extractor attached to them, others are best attached to a truck mount and a two inch vacuum line.

Light Wand - This tool is a surface extraction tool. It is used for extracting carpet that is glued down, carpet that has been extracted with a stationary tool and for extraction processes that include pad removal. It can be attached to a truck mounted vacuum or a portable extractor. A light wand cannot remove water from pad through carpeting.

Always Use 2" Vacuum Line

Always use 2" vacuum line when you are doing subsurface extraction, NEVER 1 1/2" line. 1 1/2" vacuum line moves only 60% of the air that 2" line can move. Using 1 1/2" line will unnecessarily extend extraction times and reduce the amount of water removed.

Always Extract Wet Carpet and Pad

The extraction principle is the same for carpet and pad as it would be for a glass of water. If asked to dry the glass of water you would pour the glass out first or else drying time would be unnecessarily extended. It will also take longer to dry carpet and pad that has not been extracted even if only a little bit of water can be removed.

It is expected that if you are servicing an area with wet carpet and pad that extraction be performed.
In the rare case that extraction is deemed not necessary a note must be provided to explain why not.

1.1.2 Extracting Carpet and Pad With A Stationary Tool

Stationary Tool

Stationary because you have to move it yourself, this tool is designed for subsurface extraction. That means that it will extract water from the pad and the surface of the sub flooring but not from the carpet. You must follow the stationary tool with a light wand to extract the water left in the carpet. These are best attached to a truck mounted vacuum system and a two inch vacuum line.

How it Works

The tool is designed to create a seal to the carpet and pad when you stand on it. This seal forces the airflow created by the vacuum to pass through the carpet and pad. Much of the bulk water that is in the pad will be removed during this process, but not much of the water will be removed from the carpet.

5 Step Extraction Process

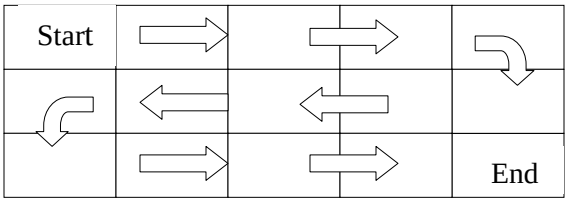
1. Attach a 2" hose to the stationary tool. Never use a 1 1/2" hose. Preferably attach to a truck mounted vacuum system.

2. Check the pad for a moisture barrier. If there is a non permeable barrier on the top of the pad, the pad cannot be saved.

3. Test extraction. Start in one corner of the room. Stand on the Stationary Extraction Tool for 5 seconds and remove. Disengage the carpet and squeeze the pad. If you are able to squeeze out any water you need to extract more. Put the tool back down and extract for another 3-5 seconds and check pad again. When you cannot squeeze any water out of the pad you know how long to extract the entire wet area.

4. Consistently extract for the same amount of time across the entire wet area. Be careful to count out the extraction time and do not change the pace.

Follow an extraction pattern similar to below. Do not leave gaps between each extraction.



5. Extract the carpet with a light wand. This is to remove the bulk water from the carpet.

1.1.3 Extracting Carpet and Pad With A Ride On Tool

Ride On Tool

Ride on because you… ride on it, this tool is designed for extraction of carpet and pad. These are best attached to a truck mounted vacuum system and a two inch vacuum line or an integrated vacuum system if available.

How it Works

The tool is designed to compress the pad with either a drive wheel or glide, wringing out the water when you stand on it. The principle is much like getting the water out of a sponge. Once the water is free from the pad the airflow created by the vacuum pulls the free water out. When done properly it may be possible to extract enough water from the pad to eliminate the need for removal of wet pad.

4 Step Extraction Process

1. Attach a 2" hose or integrated vacuum system to the ride on tool. Never use a 1 1/2" hose. Preferably attach to a truck mounted vacuum system.

2. Check the pad for a moisture barrier. If there is a non permeable barrier on the top of the pad, the pad cannot be saved.

3. Test extraction. Start in one corner of the room. Stand on the Ride On Extraction Tool drive into the corner and then back out. This is 2 passes. Disengage the carpet and squeeze the pad. If you are able to squeeze out any water you need to extract more. Put the tool back down and extract for another 2 passes and check pad again. When you cannot squeeze any water out of the pad you know how many passes to make over the entire wet area.

4. Consistently extract for the same number of passes, at the same speed, across the entire wet area. Be careful to stay away from walls and furniture to prevent damage..

Extract in straight passes all the way across the affected area, back and forth. Do not leave gaps between each extraction pass. Put any cords or hoses to one side and work away from them to make extraction easier.

1.1.4 Extracting Carpet and Pad With A Ride On Tool (Rover)

These are best attached to a truck mounted vacuum system and a two inch vacuum line or an integrated vacuum system if available.

Inspecting the Padding

Properly disengaging the carpet is required to prevent delamination. The proper process requires that we use a knee kicker and an awl to release the carpet from the tackless strip. This prevent damage to the backing while checking the pad below.

Check to see that water freely moves through the surface of the padding. If not, there may be a moisture barrier on the surface of the pad requiring removal of the pad.

Do an extraction test to determine how many passes are necessary to extract sufficiently then consistently follow that pattern.

How it Works

The tool is designed to compress the pad with glide, wringing out the water when you stand on it. The principle is much like getting the water out of a sponge. Once the water is free from the pad the airflow created by the vacuum pulls the free water out. When done properly it may be possible to extract enough water from the pad to eliminate the need for removal of wet pad.

Balance your weight by moving as far to the front as possible while extracting and moving toward the back, or over the drive wheels when turning side to side.

4 Step Extraction Process

1. Attach a 2" hose to the Rover. Never use a 1 1/2" hose. Preferably attach to a truck mounted vacuum system.
2. Check the pad for a moisture barrier. If there is a non permeable barrier on the top of the pad, the pad cannot be saved.
3. Test extraction. Start in one corner of the room. Stand on the Rover, drive into the corner and then back out. Disengage the carpet and squeeze the pad. If you are able to squeeze out any water you need to extract more. Put the tool back down and extract and check pad again. When you cannot squeeze any water out of the pad you know how many passes to make over the entire wet area.
4. Consistently extract for the same number of passes, at the same speed, across the entire wet area. Be careful to stay away from walls and furniture to prevent damage.

Extract in straight passes all the way across the affected area, back and forth. Do not leave gaps between each extraction pass. Put any cords or hoses to one side and work away from them to make extraction easier.

1.2.1 Air Mover Identification and Testing

3 types of air movers: Laminar, Axial, and High Pressure Axial

Laminar – Moderate CFM production at medium to low amp draw in newer models. Focuses air low on the wall and in a straight line. Features fairly substantial static pressure and a snout so that many attachments such as wall injection and TEX boxes can be attached. You can also float carpet with a laminar air mover.

Axial – Produces the highest CFM with the lowest amp draw. Does not focus air flow well. Best for pushing high volume air across wall and floor surfaces. Very low static pressure means that this unit cannot be ducted.

High Pressure Axial – Delivers high pressure air flow and high CFM. It comes at the cost of high amp draw and exceptionally loud operation. Specialty application only. Can attach duct to push or pull air when working with areas like crawlspaces.

3 Factors For Evaluating an Air Mover

CFM - (Cubic Feet per minute) A measurement of the volume of the the air that an air mover is moving

CFM Formula CFM =

Air velocity (feet per minute) X Area of opening

Can use an anemometer to determine velocity and subsequently the CFM of an air mover. Reading will vary across the opening of an air mover.

Air Focus

While the output CFM of an air mover is important, it is the CFM that gets to the water that creates drying. Since air flow speeds energy transfer, often you can see the heat signature of the air flow with an IR camera. The heat signature that an air mover puts onto a surface indicates the effect of the CFM that is getting to the water at that surface.

Laminar air movers focus air better near the base of the wall while axial air movers distribute air over a wider, less defined area.

Amp Draw - A measurement of the amount of electricity that is required to operate an air mover. Older air movers may pull 7 or more amps per unit. More efficient air movers draw less than 3 amps per unit. Efficient air movers are beneficial for at least 2 reasons:

1. You can use more air movers per circuit. Once you know how many amps a circuit in the structure will provide, simply add up the number of amps that things plugged into that circuit are demanding. The total amp draw of all units combined must be less than the maximum amp rating of the circuit. Multi speed air movers draw less amperage on lower speeds.

2. Efficient air movers create less BTU's (unit measurement of heat).

BTU's Per Hour Formula

BTU's per hour = (Amps X Volts) X 3.412

1.2.2 Air Mover Best Application and Placement

Class of Loss

CLASS 1 LOSS
Water not wicked up wall more than 24 inches
No wet carpet or pad
Best air mover: Laminar
24 inches
No Carpet or Pad
reets

Class 1 - Water less than 24 inches up the wall. No carpet or cushion present. Plywood or concrete subfloor.

Since a laminar air mover keeps airflow better focused on the base of the wall it has a little advantage over the axial. This is not to say that axials should not be used on this class of loss.

Class 2 - Water less than 24 inches up the wall. Carpet and pad are wet.

Since a laminar air mover keeps airflow better focused on the base of the wall it has a little advantage over the axial. This is not to say that axials should not be used on this class of loss. If floating of the carpet is the desired drying method, a laminar must be used.

CLASS 3 LOSS
Water on walls, ceilings and flooring
Needs air flow all over
Best air mover: Axial
Water On Walls
Water On Floor

Class 3 - Water on virtually all surfaces including walls, ceilings and floors. Carpet and pad are wet.

Axial air movers are better at distributing air over large areas. Class 3 makes the ideal environment for an axial air mover.

Class 4 - Specialty drying. Includes hardwood, concrete drying, plaster, etc.

The choice of air mover for Class 4 is strictly dependent on the design of the drying process.

Angle of the air mover

Changing the angle of the air mover creates dramatic change in the direction and velocity of air flow.

Steep angle to the wall (approximately 45 degrees) - Air moves up the wall, but much less velocity down the length of the wall. Also, creates greater pressure at the base of the wall.

Best application - Areas of a water loss that affect walls more than 24 inches high. Also areas where the base has been removed and you need to force air into a wall cavity.

Shallow angle to the wall (approximately 15 degrees) - Air moves farther and faster down the length of the wall but doesn't travel up the wall very high.

Best application - Areas of a water loss that do not affect walls higher than 24".

Drying Corners and Door Openings

Split corners and openings so that the dense materials are getting significant air flow.

(For information on number of air movers to place, reference 1.2.3 Setting the Right Number of Air Movers.)

1.2.3 Setting the Right Number of Air Movers

It is important that you understand which air movers to use and how to place them, but you must also use the right number of air movers. Since air movement is a key factor in creating evaporation, not setting enough air movers will cause the job to take too long and leave wet areas. Setting too many air movers will cause the bill to be unnecessarily high. For these reasons we need to be sure to set the right number of air movers and follow a guideline. While we use specific numbers below, this is a guideline that you may choose to adjust up or down based on professional judgement.

The IICRC S500 Water Damage Standard gives us a couple guidelines that help us to determine how many air movers to set:

1. Class of Loss

2. Air movement on all surfaces

Class of Loss

Class 1 - Water less than 24 inches up the wall. No carpet or cushion present. Plywood or concrete subfloor.

If drywall is wet, set one air mover every 12 feet at a 15 degree angle to the wall.

If no drywall is present, set one air mover every 16 feet at a 15 degree angle to the wall. On interior walls with no drywall air movement would only be necessary on one side of the wall.

Class 2 - Water less than 24 inches up the wall. Carpet and pad are wet. (Most common class of loss.)

One air mover every 12 feet at a 15 degree angle.

Class 3 - Water on virtually all surfaces including walls, ceilings and floors. Carpet and pad are wet.

If using axial, one air mover every 10 feet at a 30 degree angle to the wall.

If using laminar, one air mover every 10 feet at a 45 degree angle to the wall.

Class 4 - Specialty drying. Includes hardwood, concrete drying, plaster, crawlspaces, etc.

When drying rooms with hard surface, set one air mover every 12 feet at a 15 degree angle.

When drying crawlspaces, one air mover every 150 square feet focused on the wet structural materials, not the soil or block walls.

Air Movement On All Surfaces

While the above numbers are good guidelines, the principle is getting air flow on all wet surfaces. There are any number of situations that are going to cause us to deviate from those guidelines. Here are a few of them.

Forcing air into a wall cavity, under cabinets - If you have cut the base of the wall and are trying to dry the base of a wall with a non permeable wall covering, use one laminar air mover every 10 feet at a 45 degree angle. The steeper angle forces more air into the wall cavity where the drywall is actually drying. Another result of the steeper angle and open wall is that the air flow will not go as far down the wall.

Closets, turns in a wall, corners - Any change in direction on a wall is going to affect air flow. When necessary add more air movers to make sure that you are getting air flow on all surfaces.

Very large rooms - When drying some very large rooms the air flow on the walls doesn't blow on the floor coverings in the middle of the room. When this is the case, add one air mover for every 200 square feet blowing on the floor coverings.

Floating carpet or plastic containment with direct heat equipment (TES or ETES)- When you are floating carpet or containment with TES equipment, the heated air flow should be escaping from the containment at the base of the wall. This will reduce or eliminate the need for additional air movers at the base of the wall. *(For additional direction see episode on floating carpet.)*

1.3.1 Moisture Meter Identification

Types of Moisture Meters

Moisture Probe – Good for identifying the perimeter of the water loss. It has pins on the bottom that go through carpet and pad. The meter will beep and light up when the moisture content exceeds 17%.

Hygrometer – Reads the relative humidity and temperature of the air. Most models will also convert these readings to Grains Per Pound and/or Dew Point. Professional models will acclimate, or give you the correct reading, in 30 seconds or less.

IR Thermometer – This thermometer uses Infrared Technology to determine the temperature of a surface. If we know the temperature of a surface, then we know the temperature of the water on that surface. This is critical to figuring out the Vapor Pressure of that water.

Invasive Moisture Meters - Has pins that you put into the materials and gives you the moisture content of the materials by percentage. It leaves holes behind because of the pins, so use caution when checking for moisture and don't unnecessarily damage materials.

Non Invasive Moisture Meters - No pins are used. This meter will give you a relative moisture content reading up to 3/4" into a material. This is very useful for surveying materials to see if they are wet.

3 Things Meters Tell Us

What Is Wet?

Moisture Content of Materials

Are You Set Up To Dry?

Meters Help Us To Reach Our Objectives

Speed up the drying process

Document the drying process

1.3.2 Using Hygrometers and IR Thermometers

Hygrometers

Reads the relative humidity and temperature of the air. Most models will also convert these readings to Grains Per Pound and/or Dew Point. Professional models will acclimate, or give you the correct reading, in 30 seconds or less.

6 Reasons Why Your Hygrometer May Give You Inaccurate Readings

1. Getting the sensors on the meter dirty - It is best to keep the meter sensors covered when not in use. See details on calibration below as the sensors may need to be repaired or replaced.

2. Storing in extremely hot or cold conditions - Keep your meters in the office instead of storing them in your truck.

3. Loss of calibration - See details below.

4. Not allowing time to acclimate the hygrometer - Allow the meter enough time to acclimate, or give you an accurate reading, for each reading that you take. Depending on the meter and the change in environment, this can take from a few seconds to a few minutes. You will know that the meter is acclimated when the numbers stop consistently rising or falling. Expect that the reading will continuously vary up and down slightly.

5. Weak batteries

6. Extremely hot or cold environments will cause the readings to be somewhat inaccurate.

How to Check for Calibration of A Hygrometer

Take 3 hygrometers and place them in the same area. If one of the hygrometers is significantly different that they others it needs to be replaced or recalibrated by the manufacturer. Contact the manufacturer of the meter for details on how to do this.

Information From The Hygrometer

The temperature and relative humidity readings can tell us a lot about the drying environment that we have established. The temperature tells us how much energy is available to do drying with. The relative humidity tells us how vapor is going to equalize.

Combined we can calculate specific humidity tells us specifically how much water is in the air. This helps us to determine the EP of a drying environment and whether we are adequately controlling the humidity in the environment.

Infrared (IR) Thermometer

This thermometer uses Infrared Technology to determine the temperature of a surface. If we know the temperature of a surface, then we know the temperature of the water on that surface. This is critical to figuring out the Vapor Pressure of that water.

Information From The IR Thermometer

Get as close as you can to the surface. If you are too far away the reading will be less accurate as it will give you an average of a large area.

The surface temperature readings can be evaluated to determine Evaporation Potential. By comparing surface temperature to dew point we can determine if condensation or evaporation will occur. When taking invasive moisture readings surface temperature will play a big part in correcting the moisture readings.

1.3.3 Invasive Moisture Meter Application

An invasive meter uses pins to detect moisture. The meter measures the resistance between the pins and converts this into moisture content percentage. There are a variety of different types of pins.

Adjusting Readings for Surface Temperature

Invasive meters are designed to take readings on materials that are about 70F. When the temperature of the surface you are reading is above 70F, the reading on the meter is incorrectly raised. If the temperature of the surface is below 70F, the reading is inaccurately low. To get the correct reading you must adjust for the temperature of the surface.

For example, if you are using a Delmhorst Invasive Meter on a 100F surface and the meter says 15% the accurate reading once temperature is accounted for is 12%.

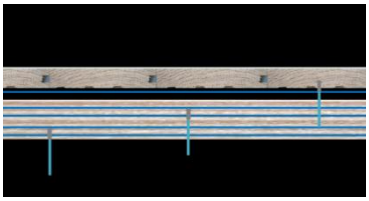
There are two ways to make this adjustment:

Use the chart or formula that is found in the owner's manual of the meter that you are using. The chart or formula will tell you how to adjust the reading on the meter.

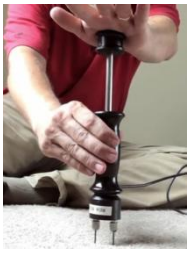
The Delmhorst Navigator gives you the ability to enter the surface temperature and the meter will make the necessary adjustments to give you the correct reading.

Attachments For An Invasive Moisture Meter

Hammer Probe



A weighted slide pounds insulated pins into wood materials to take readings at multiple depths. Using insulated pins means that we can see where the moisture is in a material. We do this by taking readings at multiple depths. This allows us to see exactly where the moisture is. That is important for deciding where our drying is most effective and making sure that we have removed the moisture from the middle of the materials.



When hammering the pins into or out of materials be careful not to pinch your hand or damage the pins.

Paddle Probe

Two flat insulated paddles can be used to check under sill plates and behind baseboard to check areas that hammer probe pins can't reach.

Setting Screws

Screws can be set into materials to extend the reach of the meters that we are using. By having screws of multiple lengths we can check areas like base plates. For this to be successful a couple of tips might be useful:

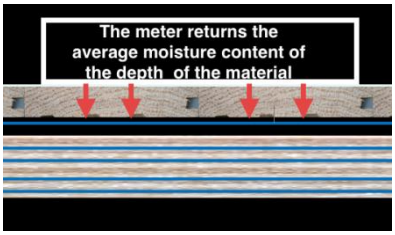
Make sure that you mark the screws so that they can easily be found again.

Use a star drive screw instead of phillips head.

Make sure the two screws are spaced the same as the pins on your meter.

Once the screws are in place you can touch the pins of your meter to them and get a reading that represents the highest moisture content across the length of the screws.

1.3.4 Non-Invasive Moisture Meter Application



An non invasive meter uses radio frequency, conduction or capacitance to detect moisture. The meter returns a relative number, not a moisture content percentage, to indicate the presence of moisture. The most important feature of this type of meter is that it gives you some indication of the presence of excess moisture in materials without making holes in the material like an invasive meter.

Understanding Relative Readings

First, why do wood moisture equivalent, or moisture content percentages not apply to noninvasive meters? The meter takes an average of the moisture content across the mass of material. That means that if the material is very wet on the bottom but not on the top (as in the case of water damaged hardwood flooring) it will take an average and show that as the moisture content percentage. The percentage will be much lower than the actual moisture content of the bottom of the wood. This could lead one to incorrectly believe that a material is dry when it is actually still wet.

That is why relative scales, or a scale from 0-100 or 0-1000 or 0-300 are used. This means that you must interpret the readings from the meter. You need to take comparative readings, or readings of both affected and unaffected areas, and identify areas with elevated readings. When taking comparative readings they must be the same type of material. You can't take an unaffected reading of drywall and apply it to a wood subfloor, for example.

Temperature also affects readings from the materials. Higher temperatures will raise the reading on the meter and lower temperatures will lower the reading of the meter. This will come into play when the environment that you are drying in is significantly warmer than the

unaffected areas. There is no way to correct this, you must just account for it.

Proper Application

Hold meter at the correct angle to the wall. Check the user's manual of your meter for correct angle.

Take readings in an area you believe to be unaffected. Then go to an area that you believe is an affected area. Compare the readings. A significantly higher reading indicates excess moisture.

During monitoring visits, start by checking the unaffected areas, take readings on the areas that you identified as wet and record the readings taken until unaffected and affected areas are a similar reading.

Limitations Of A Non Invasive Moisture Meter

Initial readings on materials in an affected room may read very high due to condensation or high humidity in the air equalizing with materials in that area and not from water running on or wicking into those materials. Checking these materials again on the second day of drying may give you a better indication of the dry standard for those materials.

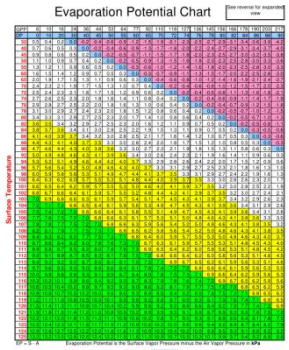
Most non penetrating meters read up to 3/4" of depth. This limits its use to materials that do not exceed 3/4" of depth.

Usually not used for final moisture readings in hardwood floors due to the thickness of the materials.

Not effective in detecting moisture in all of the materials behind baseboards because of the thickness of the materials compared to the depth of the meters reading.

You will get a false positive reading from metal corner bead, foil backed insulation behind drywall and foil backed wallpaper to name a few.

1.4.1 Dehumidification's Role in Drying



Definition of dehumidification: Removing moisture from air.

Dehumidifying the air is important in two different ways:

1. Expedite evaporation

2. Remove excess water from the building.

Expedite Evaporation

The way that we determine the Potential for Evaporation is by looking at the difference between the vapor pressure of the water and the air. In simpler terms, we use our EP chart.

Get out your EP chart. Look at the effect on the EP if we have a 70F surface and we lower the humidity ratio in the air from 80 GPP down to 50 GPP. If the temperature of the material remains the same there is improvement in the EP. There is more Potential for Evaporation.

Remove Excess Water

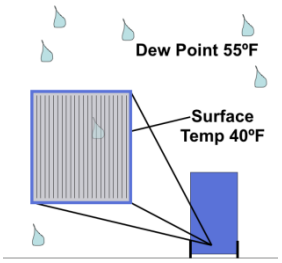
Create a balanced drying environment. This means we need to remove moisture from the air through dehumidification *at least* as fast as we are evaporating moisture into the air. Preferably we want the capability to remove more moisture than we are evaporating into the air.

If excess moisture is not removed problems can occur in three ways:

1. Equilibrium between the moisture in the air and the materials is reached and drying stops.

2. The dew point of the air rises above material temperatures. At that point condensation starts to form on surfaces in the building.

3. ERH (Equilibrium Relative Humidity) increases and material moisture content increases.



2 Types of Dehumidifiers

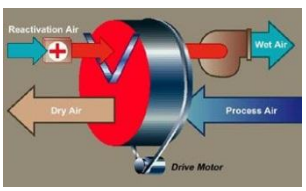
There are two basic types of dehumidifiers:

1. Refrigerant - Includes Standard, LGR, High Temp LGR.

Removes moisture by blowing air across a coil that is colder than the dew point of that air. Moisture then condenses and drips into a reservoir.

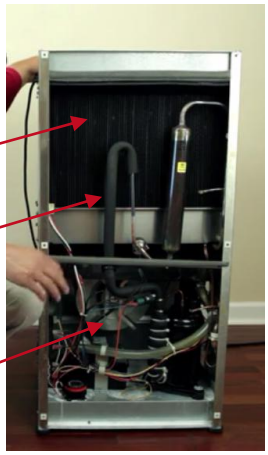
2. Desiccant

Absorbs water from humid air into the silica gel on a desiccant wheel. Hot reactivation air is then blown over the silica gel to release moisture into air that is blown outside.



1.4.2 Using LGR Dehumidifiers

LGR Components



LGR (Low Grain Refrigerant) - Its a refrigerant, so it works on condensation and dew point. Low Grain indicates that it can work to a lower grain load or dew point than a standard refrigerant.

LGR Operation

LGR dehumidifiers accomplish two things:

1. They remove humidity from the air.

The main difference between a standard and low grain refrigerant is the addition of an air-to-air heat exchanger that pre cools the incoming air.

This pre cooling lowers the moisture temp so that condensation and moisture removal will continue to a lower point.

Standard Refrigerant may remove moisture from the air to as low as - dew point 52 or mid 50s GPP.

Low Grain may remove moisture from the air to as low as 38 DP or 33 GPP, but don't expect this unless the air entering is extremely dry and cool. If you look at the EP chart there is potentially a difference of .5 EP between LGR and standard refrigerant Dehumidifiers.

2. They heat the air.

You will note that the air coming out is much warmer. This heat helps add energy to the air that can subsequently work to create evaporation.

Determine Dehumidifier Performance

A dehu is supposed to remove moisture, so the air going into the dehu should contain more moisture than that leaving. Specific humidity can tell us exactly how much water there is in the air.

Take a reading at the intake, and at the exhaust. The difference in specific humidity is called *grain depression*. If there is no difference in and out of the unit then the unit is either not working or the incoming air is too hot and or dry for the unit to continue removing moisture.

The difference in specific humidity between air in and out of the dehumidifier indicates performance.

LGR Usage Tips

It can be very useful to duct the air coming out of the dehu. This can be ducted to an air mover, under containment or into a crawlspace.

The water being collected by the dehu will be pumped out through a line. Be sure to secure the line to the drain that you are using so that . Don't let the line get

crimped or it may cause the dehumidifier to leak. Putting a special made pan underneath the dehu to catch potential leakage may be a wise decision.

High Temp LGRs

High temperature LGR units are designed to be able to operate in environments above 90F. These can be useful when you are raising the temperature of the wet materials and are utilizing a closed drying environment. For example, when you use an ETES to apply heat wet materials, a High Temp LGR may be a good solution for humidity control.

Some of these units automatically adjust for high temperature air entering the unit. Others have a vent that must be uncovered when the ambient air is above 90F. If you are using a High Temp LGR make sure the vent is covered when the air is below 90F or the unit will not function properly.

1.4.3 Setting The Right Number of LGR Dehumidifiers

Setting the right number of LGR Dehumidifiers is critical. Our job is to get the moisture out of a building. Not setting enough dehus will cause secondary damage and slow drying. This also reduces your average dollar sale, creates liability and extends the time that you are in a building. Setting too many units without justification will create problems as the bill becomes exorbitant and reveals a lack of understanding. Setting too many dehumidifiers will not speed drying.

2 Factors That Determine Number of Units

Since dehumidifiers remove moisture from the air *and* heat the air there are two things that we look at to determine how many units to place.

1. The rate of evaporation

The type of loss is classified 1-4 based on the rate of evaporation and this gives us a baseline for how many LGR units to use.

2. Evaporation Potential.

Both the heat from the LGR that is transferred into the water and the reduction of the vapor pressure of the air due to removing moisture increase Evaporation Potential.

1. Calculating Number Based on Class of Loss

The formula for determining a beginning number of LGRs based on the class of loss is fairly straightforward.

Cubic Footage of Affected Area_____\ Class Divisor_____=

Pints of Dehumidification_____\ Pints Per Day Rating of LGR_____=

Number of Units_____

Once you know the number of pints of dehumidification, then you look at the number of pints that your model of dehumidifier removes and add enough to meet or exceed the demand. Below is the Class of Loss Divisor Chart for LGR dehumidifiers. Use this chart after referencing the class of loss descriptions.

Divisor	Class 1	Class 2	Class 3	Class 4
LGR	100	50	40	50

Class of Loss Description

Class 1 - lowest rate of evaporation. No carpet or pad. Water less than 24 inches up the wall.

Class 2 - higher rate of evaporation. Wet carpet and pad. Water less than 24 inches up the wall.

Class 3 - highest rate of evaporation. Wet carpet and pad. Water in walls and ceilings.

Class 4 - specialty drying. Wet hardwood, plaster, ceramic tile over wood subfloor, crawlspaces, etc.

How Many Pints?

Scenario 1 - A water loss is 30' X 40' with 8' ceilings. There is water in carpet and pad and it has wicked into the walls 12". How many pints of LGR dehumidification should you start with?_____

Scenario 2 - A water loss is 25' X 32' with 12' ceilings. A pipe broke in the attic and wet ceilings and walls and carpet. How many pints of LGR dehumidification should you start with? _____

Now divide the pints needed by the number of pints per day that your model LGR removes. This tells you how many units to use.

2. Using EP to Determine Dehumidification Requirements

Class of loss doesn't tell everything. Using EP is a very important way to justify the use of dehumidifiers.

The above calculations are to be adjusted as deemed necessary based on professional judgement. Professional analysis of the vapor pressure differentials between air and water will help you determine whether you should add or remove dehumidifiers in a drying environment. Evaporation Potential is the tool that makes this possible.

Dehumidifiers both dry and heat the air. Removing a dehumidifier will cool the air and the water in the environment, and possibly allow the humidity to rise. Conversely if the EP is below goal (minimum acceptable EP when using LGRs is 1.5) adding a dehumidifier will increase EP by heating the environment and drying the air. There is a direct connection between the EP and how long drying will take.

Times to consider adding additional LGRs include: drying environments where HVAC must be kept below 75F, no HVAC available, extremely humid exterior environments, EP below 1.5.

1.4.4 Using Portable Desiccant Dehumidifiers

Desiccant dehumidifiers adsorb moisture from the air into silica gel. Desiccant dehumidifiers have the ability to draw the moisture content of the air to a lower range than refrigerant-type dehumidifiers.

Desiccant Operation

Desiccant dehumidifiers accomplish two things:

1. They remove humidity from the air.

Desiccant dehumidifiers can effectively remove moisture from the air to extremely low levels. The performance of the dehumidifier will be enhanced when it draws in cold, dry air.

2. They heat the air.

You will note that the air coming out is much warmer than what is entering. This energy in the air can subsequently work to create evaporation.

How They Work

The unit requires two air streams to remove moisture from the building.

1. Process air - This air stream is drawn into the unit, drawn across the desiccant wheel and dried, then it is blown into the drying environment.

2. Reactivation air - This air stream is heated and blown across the desiccant wheel to remove the moisture from the silica gel and exhaust it out of the structure.

Ducting A Desiccant

Since there are two air streams, there are 4 ducting locations found on a portable desiccant: the intake and exhaust for both the Process and Reactivation air.

Process Air

The air that is drawn into the unit to be dried should be the coldest and driest air available. If that is in the drying environment there is no need to add Process intake ducting. On the other hand, if the desired air is outside, then draw that air into the unit by running a duct to the exterior of the building.

You may also duct the Process exhaust air (the warm, dry air produced by the dehu) into a containment if that is necessary. If you are containing the process air to a hardwood floor for example, duct that air into the containment.

Reactivation Air

It is not usually necessary to duct air into the Reactivation intake.

The Reactivation exhaust **must** be ducted to the exterior. This is the air that is removing the humidity from the building. The duct must be kept in good shape because moisture will condense inside the ducting and if there are holes in the duct, water will leak out and create a new water problem.

Working With Pressurization

Since we are ducting air into and out of the building we will change the pressure of the drying environment. This will either draw air to, or push air out of the drying environment.

There are three different pressures that may be created:

1. Negative Pressure - This means that air is being pushed out of the drying environment and air outside the drying environment is therefore being drawn in. This is usually created by just attaching the Reactivation exhaust ducting and blowing that to the exterior of the building.

2. Neutral Pressure - Neutral pressure means that the same amount of air is being drawn into the containment as is being exhausted from it. This can be created by attaching a duct to both the Reactivation intake and exhaust and running both ducts to the exterior of the building.

3. Positive Pressure - Positive pressure is created by drawing more air into the drying environment than is being exhausted from it. This pressure causes air inside the drying environment to be pushed out of the contained area. This can be created by ducting the Process intake in from the exterior to draw in cold dry air from outside.

Considerations

When the only air available to be drawn through the unit is very hot and humid, the efficiency of a desiccant will be adversely affected. It may be better to choose another type of dehumidifier.

Portable desiccants require a significant amount of electrical power to heat the Reactivation air stream. If power limitations exist, it may not be possible to use a portable desiccant on that job.

1.4.5 Application of Portable Desiccant Dehumidifiers

Application of portable desiccants is most often specific to an area as opposed to the entire structure. We will look at how many desiccants to use on a job as well as how to decide whether to use outdoor air or drying chamber air to draw through the desiccant.

Determining How Much Dehumidification to Use

There are 2 primary considerations that help us determine dehumidification requirements:

1. Class of loss calculations

2. Effect on Evaporation Potential

The standard amount of dehumidification necessary may initially be determined with a formula. Unlike the LGR divisor which gives you pints of dehumidification needed, the desiccant divisor gives you CFM. This is also how desiccants are rated.

The Class of Loss formula is based on class of loss and cubic volume of air. Each class has a different divisor for the cubic footage. Class of loss is simply a way of estimating the rate of evaporation 1 being lowest and 3 being highest and 4 being specialty drying. You may notice that Class 2 and 4 share the same divisor.

By examining the chart you will also see the greater the anticipated evaporation rate the more dehumidification needed. However as the rate of evaporation is only an initial guess so also is the recommendation for dehumidification a guess. Lets look at the different classes of loss.

Divisor	Class 1	Class 2	Class 3	Class 4
Desiccant	60 (1 ACH)	30 (2 ACH)	20 (3 ACH)	30 (2 ACH)

Class of Loss

Class 2 losses (most common type of loss) and *Class 4* losses (hardwood, plaster, concrete, crawlspace) use the same formula. Class 2 is a loss where the water has not wicked up the walls more than 24 inches but differs from Class 1 in that there is wet carpet and pad in a Class 2 loss. Notice that the desiccant divisor is 30. Now lets work through a problem. You have an affected area of 40' X 30' X 10' foot ceilings. The cubic footage is 12000 ft. Divide that by 30 (desiccant divisor) and you get 400 CFM. Based on the rating of your dehumidifiers choose enough dehumidifiers to produce *at least* 400 CFM of dehumidification for this area.

Class 3 loss. These are losses where water is on walls, ceilings and flooring. The formula is the same but the divisor is 20. Take the same 30' X 40' X 10' affected area. There are 12000 cubic feet. Divide that by 20 (desiccant divisor) and you get 600 CFM. Based on the rating of your dehumidifiers choose enough dehumidifiers to produce *at least* 600 CFM of dehumidification for this area.

Class 1 is similar to Class 2 by definition except you don't have carpet and pad in Class 1. That dramatically reduces the amount of water left in the building and reduces the amount of dehumidification needed. The divisor for Class 1 is 100. Take the 30' X 40' X 10' area (12,000 cubic feet) and divide by 60 (desiccant divisor) and you have a starting point of 200 CFM. Based on the rating of your dehumidifiers choose enough dehumidifiers to produce *at least* 200 CFM of dehumidification for this area.

Evaporation Potential

Class of loss doesn't tell the whole story. As you near the end of a job, there may be plenty of heat and very little water being removed. In this case, from a moisture removal standpoint, it would make sense to remove some dehumidification. You may even get pressure from an adjuster to do so.

On the flip side by removing dehumidification you may reduce EP because the humidity in the environment increases and the available energy goes down. That obviously would not make sense.

Or when a customer insists on temp staying low in the unaffected area it may make sense to add more dehumidifiers than initially recommended to increase the temperature of the drying chamber so that you have energy to transfer into the wet materials.

When you are recording EP daily, you can show the benefit or detriment effected upon the drying environment by adding or removing dehumidifiers. After having made an adjustment the following day the EP will have either risen or dropped and we can quantify the effect of the change that we have made. Obviously we want each adjustment to raise the EP as this indicates that the conditions will speed evaporation.

Draw in Inside or Outside Air?

To use a desiccant you must be able to get access to outside air since you must exhaust the reactivation exhaust (hot and humid) air. This means that we can also easily draw either inside or outside air thru the unit to be dried.

Choose the air that is coolest and driest.

Using a hygrometer take the temperature and the humidity ratio (GPP, Dew Point or Vapor Pressure) of the outside air and then the air inside the drying chamber. The air that is coolest and driest is the best choice. If the temperatures are similar choose the driest air mass.

The temperature and humidity ratio of the drying chamber **will** change during the course of the job. So while Day 1 one it may be best to draw in the outside air on Day 2 or 3 or 4 the air may be significantly drier inside making it wise to start drawing in the air in the drying chamber. Professional judgment based on these readings will help you make portable desiccants most effective.

1.5.1 Power Management on Water Losses

On water losses the equipment that we place in a building creates a large demand for power. Each air mover or dehumidifier or air scrubber or directed heat system needs power to operate and the larger the loss is the harder it can be to find that power. Often there is enough power in the building, but you must find the power and balance the power load.

Determining Power Requirements

2 questions that we must answer when determining power needs in the drying environment are:

1. How much power is needed?
2. How much power is available?

Determining Power Draw

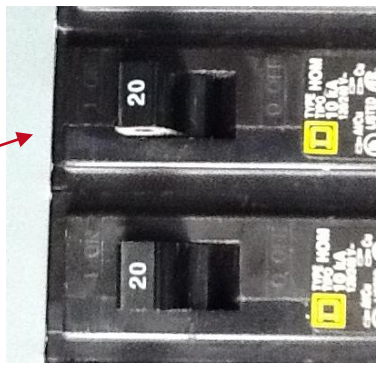
Look at the tag on the air mover, dehumidifier, ETES or whatever piece of equipment you are using. Determine the Amp draw. On this air mover the draw is 2.9 Amps.

We also determine voltage. This ETES unit draws 25 Amps at 240 Volts. That means that this unit must be plugged into 240V power. This is most commonly found as a dryer or range outlet.

Look at each piece of drying equipment and add up the total amount of power that will be consumed by each unit. Once you see what the power draw from your equipment is, then you need to find that power in the building.

Available Power

Look at the breaker box and see how much power is available for each circuit. The number of amps is printed on the circuit breaker. It can be difficult to determine which breaker belongs to the circuit you are plugging into. Even when breakers are labeled they are often incorrect.



This breaker is rated at 20 Amps but only about 80% of this is available for continuous load. That means that we should expect to use a maximum of 16 Amps of continuous power. If more is plugged in, likely the breaker will pop at some point during the course of the job.

Sometimes amps of power needed is simply not available where you need it or in the voltage that you need. For example you may need 48 Amps of 120V power in a basement. If that basement only has two 15 Amp 120V breakers for

outlets in the basement you must get power from somewhere else. You may choose to run properly sized extension cords from another portion of the house to bring the power to the basement.

You may also use a power distribution box if 240V power is available to you. 240V power is most commonly found as a dryer or range outlet. In some cases you may need to call an electrician to install a 240V outlet at the breaker box so that you can use a unit such as this one. The power distribution boxes shown here provide you with 120V outlets. This is a very simple solution to a challenging job like the basement mentioned above.

Practical Application

The scenario presented in the ReetsTV episode asks whether we have properly distributed the power needs for our equipment in a water loss. Here is the setting:

We have plugged our equipment into 2 120V 15A circuits. We have installed 7 air movers. Each of these air movers draws 3 Amps. We are also using 1 dehumidifier that is using 7.5 Amps.

1. Do we have the equipment properly installed with regard to the power available?_____

2. Why or why not?_____

In addition, in the crawlspace we have a 120V ETES that draws a total of 24 Amps and 2 air movers that draw 3 Amps each.

3. What is the total Amp requirement of all of the drying equipment in both the crawlspace and the living area?_____

Answers to these questions are found on the following page.

Answers

1. No.

2. We are drawing 28.5 Amps off of two 15 Amp breakers. At 80% continuous load those breakers will only allow 24 Amps. The breakers will trip at some point.

3. 58.5 Amps

1.5.2 Electrical Basics and Safety on Water Losses

Electricity is a factor on every water loss. Whether we are dealing with safety issues or trying to find power a better understanding of electricity and how it affects us on a water loss is necessary.

Electrical Basics

Amperage - Amount of electricity or current moving thru the line

Voltage - How fast the electricity is moving thru the line

Continuous Load Vs. Max Load

A breaker is designed to allow approximately 80% of the stated load as a continuous load. A spike of electricity, like during equipment startup, is allowed up to the full amp rating. If you exceed that 80% load the breaker will likely hold for an extended period of time but not for the entire job and you will find breakers tripped on monitoring visits.

Dedicated Outlets

Some circuits, called dedicated circuits, only have one outlet on them. These are very helpful because you know exactly how much draw you have placed on that circuit. The following are areas you may locate a dedicated outlet:

- Washer
- Refrigerator
- Freezer
- Microwave

Kitchen and GFI circuits are usually not dedicated but may only have two or three outlets per circuit.

Extension Cords

Distance, amp draw and gauge of the wire are factors that will affect extension cord usage. When any of these are excessive there will be at least a voltage drop and you could potentially create a fire hazard. Things to avoid:

- Running extension cords more than 50 ft.
- Amp draw in excess of the rating on the cord
- Extension cords smaller than 12 gauge (14 gauge is smaller than 12)

Power Distribution Box

A power distribution box provides both safety and convenience. It brings power closer to the area that you are working in and provides a sub panel for an additional safety factor. *Always* use the correct cabling between the distribution box and the building even though these cables are very

expensive. These boxes plug into 240V power and break that power down to 120V giving you dedicated outlets on the box.

When no 240V is available but more power is required it may be necessary to call an electrician to add a breaker and outlet at the main panel. Usually the customer will want that removed at the end of the job.

Arc Fault Breakers (pictured at right)

Avoid using these circuits if possible because of the sensitivity of the breakers.

Generators

If a generator is needed, do not tie it into the main panel. Do make sure that it is properly grounded.

Electrical Safety

GFI Outlets

A Ground Fault Interrupter (GFI) is designed to interrupt the power in the case that there is leakage of power between the hot wire and the neutral or ground. This is extremely important when water is present. Therefore GFI devices are an important protect on water losses. Do not attempt to eliminate GFI protection on equipment, cabling or outlets.

Missing Ground Blade

All equipment and cabling should be properly grounded. If a ground is missing from a cable, that plug or cable should be replaced immediately.

Calling An Electrician

When water has run through or is sitting in an electrical connection there is the potential for an electrical short or shock. In this case it is important to contact a professional electrician to make the building safe. Although we cannot list every situation when you should call an electrician we will note a few times when it is necessary:

Water has run through the main panel

Wires have been pulled loose

Water has run through lights or outlets

Any time you are unsure whether the electrical system has been compromised by the water loss

It is important to develop a standing relationship with a quality electrician that will be able to respond to emergency water losses. It will be nearly impossible to find an electrician if you wait until you are on a loss after hours.

1.5.3 - Applied Power Management

It is a regular occurrence that finding power is going to be an issue. It is important to both understand why this happens and have a strategy in place to correct it.

Why Breakers Trip

There are two primary reasons that breakers trip when we are plugging in our equipment. While both are associated with drawing too much power for the rating of the circuit, there are are two different thresholds that cause the breaker to pop:

1. Exceeding the peak amperage draw for the breaker. More amperage is used than is posted on the breaker and it trips immediately.

2. Exceeding the continuous load rating. Breakers only allow about 80% of peak capacity for continuous load. Exceed the continuous load rating and the breaker may not trip for several minutes, if not hours or days.

3 Strategies for Power Management

You need a plan or you will **never** get out of the building. Here are 3 common strategies:

1. Plug till they trip. Then back off a little.

2. Use a circuit analyzer and monitor.

3. Use a power distribution box to get dedicated power.

Plug Till They Trip

This is the most common, partially because often it is accidental. Since breaker panels are often mislabeled or not labeled at all, looking at the breaker panel is not extremely helpful. Often it can't be determined what circuit each outlet is on even if the panel is labeled correctly. Here is a step by step process for properly balancing the power:

Start plugging in equipment knowing that you will likely overload the circuit.

When the circuit pops look at the panel and determine how many amps the breaker that popped is. But *don't* reset the breaker yet.

Go back to the area where the equipment is off. Determine how much amp draw the equipment that is off is drawing. Unplug enough equipment to get the amp draw below the continuous rating of the breaker. Replug that equipment onto a live circuit. Now you have both relieved the excess load off of the circuit and figured out where your circuits are.

Once you have moved the equipment reset the tripped breaker and move to the next circuit.

Use A Circuit Analyzer

A circuit analyzer tells the voltage and amp draw on the line among other things. While the information it gives you is not perfect, it can be very helpful in locating a new circuit and getting an idea of how much load is on a particular line. Here's how you can use it:

Start by plugging the circuit analyzer into an outlet. Check to see the load on the line.

Start adding equipment and keep the load below the continuous load rating of the breaker.

Keep checking outlets. You will quickly see when you switch to another circuit.

Use A Power Distribution Box

If you want to avoid all of that, use a power distribution box. You know exactly what the load is and how much power you have available.

The power distribution box requires a 240V outlet preferably a 50A range plug. Sometimes this makes the use a power box impossible. On larger jobs it may be necessary to call in an electrician to install a temporary 240V outlet at the breaker panel. Once you have power available the steps are simple:

Plug in the power distribution box.

Plug in your equipment keeping the power consumption under the continuous load rating of the breakers.

No matter what you do you are going to have power issues on water losses. Having a good plan to address them will keep you sane.

1.6.1 Direct Heat Application Basics

When using heat in drying there are two basic approaches you can take: Heating the entire affected area or directing heat to the water. There is a big difference between heating a building and drying with directed heat.

Hot Air or Hot Water?

Heating air has no effect on the rate of evaporation. It increases the amount of energy in the air but the energy that makes the difference is the energy in the water. If you are going to heat the entire drying environment, you must also use lots of air movement to transfer the energy in the air into the water.

Heating water directly gets the energy into the water and speeds evaporation. Just like melting ice into liquid (a phase change) requires putting energy into the ice. In turn motivating the next phase change, liquid into vapor, requires putting energy into the water.

Experiment

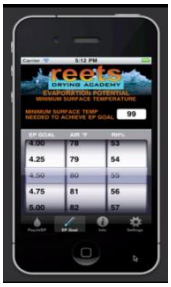
In order to prove this we did an experiment. We poured 16.9 oz of water in each of two large pans. One pan was placed in the oven at 450 degrees Fahrenheit. The other pan was placed on the stovetop with the eyes of the stove on high. This helps us to test whether the temperature of the air determines the rate of evaporation, or if the temperature of the water is more important.

Elapsed time for evaporating water out of pan on the stove top **11 minutes 10 seconds**

Elapsed time for evaporating water out of pan in the oven **35 minutes 30 seconds**

Temperature of the air above stove **95 Fahrenheit;** in oven **450 Fahrenheit**

Temperature of water **211 Fahrenheit;** in oven **170 Fahrenheit**



The temperature of the air provided no benefit when it came to evaporating the water. If it had been the important factor, the much hotter air of the oven would have caused the water to evaporate from the pan in the oven faster. Instead, the main effect came from the temperature of the water. This conclusion is supported by looking at evaporative law as well.

Direct Heat Application

Start by setting an Evaporation Potential Goal. Let's say I want an EP of 4.5 on a subfloor. Air is 80F and 55%. ReetsDryCalc tells us you need a surface temp of 99F. If I heat the entire room the area near the ceiling would exceed 115-120. This means an EP perhaps as high as 10 at the ceiling where

materials never got wet! That is going to cause damage including shrinkage and cracking of trim during the drying process.

With TES and ETES, which are the only tools designed for directed heat drying, the ambient air is heated and pushed into containment or directly onto the surface. ETES will heat the air about 25 degrees. That means to get 99 on the subfloor you only need about 85F ambient air temperature. (There will be a temperature difference between the air and the wet surface.) This is very similar to normal ambient and eliminates the problems inherent to overheating.

There is heat and then there is directed heat. Professionalism demands directed heat.

1.7.1 Ventilation During Directed Heat Drying

Drying with directed heat is done to accelerate evaporation. When you accelerate evaporation there is a lot of vapor released into the drying environment. So, why ventilate when we could just dehumidify? Directed heat can create two unwanted byproducts:

1. Excess humidity

2. Excess heat

Dehumidifiers can easily remove excess humidity, but they add heat. In many cases you must ventilate the building to get rid of both heat and humidity. Sometimes you want to preserve the heat because it is cold outside and the HVAC is not operational. Other times the heat produced can be handled by AC in summer and in the winter the heat is welcome. In those cases you can use dehumidification to remove the humidity and not ventilate.

When you need help controlling temperature, ventilation is the answer. The ventilation we discuss is not 'burping the building' or just opening windows and doors. We are talking about engineered or controlled ventilation.

Components

There are 3 components to engineered ventilation during directed heat drying:

1. Ventilation air mover and ducting

2. Thermostatic controller

3. Egress and ingress locations

For ventilation use a centrifugal air mover and ducting. This is easily set up and reused if you have lay flat duct, a 24" bungee and stainless steel ring. Cut the lay flat about 15' long as a standard knowing that sometimes you will need more. If you need less just let it run outside. After using these wrap the lay flat onto the ring and put the bungee cord around the whole package.

Next the thermostatic control. There is no need for a humidistat because with the exception of the first hour of drying, the temperature of the air rises faster than humidity level. The thermostatic controller is key because it regulates the exhaust to maintain your desired temperature. Without this you would just be guessing. Some jobs would get too hot and others would be too cold. The thermostat allows you to set the temperature that you want and keep it consistent.

If you are using enough ventilation the thermostat can insure that you can control temperature and humidity. If there is not enough ventilation, the temperature of the drying environment will not be controlled and the temperature will continue to rise out of control. When determining how much exhaust to use, always err on the side of too much ventilation and let the thermostat determine when to run the units.

In directed heat, the standard temp setting for the exhaust controller is 95F with a 1 degree differential when you are doing direct containment. This means that as the temperature hits 96F the exhaust turns on, and at 95

it turns off. If you are doing regional containment use the Evaporation Potential chart to determine the temperature needed to create a 3.5 EP and set your exhaust controller accordingly.

Choose the points where air will enter and exit the building. The exhaust unit and the incoming air must be separated or else you won't actually ventilate the environment. You want to create a river of air to flush out the moisture. Replace the air inside with the air outside. It is best to stand at the exhaust unit and point toward the ingress locations that you have set up. The area between the exhaust and the ingress points is what will be exhausted.

Process

1. Choose air ingress and egress points. Your goal is to move air through the structure. Stand at the exhaust unit and point toward incoming air. This is the path that the air will take. Are you ventilating the entire drying chamber?

2. For the first hour after starting ETES or TES, continuously ventilate. This means plugging the exhaust air mover directly into the wall, not into the controller. It takes a bit of time for the heat to increase in the room but doesn't take long for the moisture to start evaporating.

3. Set the thermostat to the desired temp. After the first hour of operation, plug the exhaust unit into the thermostat.

4. When in doubt about how much ventilation to use always use too much. The thermostatic controller will turn on and off as necessary to control temp. How many ventilation air movers should you use?

As a general rule in the summer you should use one ventilation air mover per TES or ETES box. In the winter one ventilation air mover to 2 boxes. In extremely cold environments this number may move to as high as 1:3.

5. On monitoring visits the room temp and the setting of the thermostat should be within 5 degrees of each other. If there is more than 5 degrees of difference, the ventilation is not set up properly or you need more ventilation. Go back to step one and work through each step.

1.8.1 Antimicrobial Application

The introduction of water into an indoor environment may provide ideal conditions for microbial growth. This would make the environment less sanitary. It is important to do what we can to address this even on category 1 (clean water source) water losses. The application of an antimicrobial is one simple way to reduce viable, or living, mold and bacteria and may be considered appropriate on all water losses if done properly.

3 main concerns should be addressed before applying any antimicrobial:

1. Is licensing required?
2. Are antimicrobials or disinfectants effective?
3. Is it safe?

Is Licensing Required?

Some states do require licensing for water and mold mitigation companies. If you want to find out about your state, do not rely on what you have heard. Check with your state's Department of Agriculture. Ask if antimicrobial/pesticide use by a water or mold mitigation company requires a license. Most state's requirements do not include our industry. If your state does require licensing, get licensed instead of not applying antimicrobials.

Are Antimicrobials Effective?

Antimicrobials are very effective at killing mold and bacteria. The application of an antimicrobial does not constitute mold remediation as the goal there is source removal. It can stop growth of mold though and will effectively eliminate bacteria. Obviously the application of an antimicrobial does not replace proper cleaning and other techniques.

Antimicrobials are only effective on surfaces that they touch.

Antimicrobial use must follow the directions provided by the manufacturer.

Are Antimicrobials Safe?

With regard to this question there are currently two main types of antimicrobials: botanical and not botanical.

Botanicals are very effective and do not require PPE or evacuation of the affected areas. This eliminates most health concerns for both the technicians and the building occupants making botanical antimicrobial use very safe.

Antimicrobials that are not botanical (including synthesized or imitation botanical ingredients) carry a measure of health risk. They likely require PPE for technicians and evacuation of the affected area for a period of time. Many also require cleaning following application.

You should give written notice to the customer of the products that you will apply in their building regardless of the type of disinfectant.

Always use only according to the directions for the product that you are using.

Application Guidelines

Regarding application you must follow the directions on the product you are using. For that reason we can't give an exact process here other than read the label and do exactly what it says. Here are a few general guidelines:

1. If the disinfectant is a concentrate, mix it exactly as it says. Do not make it stronger because of a particularly *bad* job.
2. Aerosolizing does not work and is potentially very hazardous.
3. These application recommendations below are assuming clean water loss. There are several other steps required if you are dealing with sewage or other black water conditions.
4. Disinfectants only work on stuff they touch.
5. Due diligence would in most cases state that you would not tear out base and drywall on a clean water loss just to apply disinfectant. Obviously each case is different so use professional judgement.
6. Typical application would be to exposed surfaces. Spray onto surfaces that water touched or has wicked into. Apply to flooring and two feet up the wall or a bit higher than the water has wicked higher in a class 1, 2 and 4 water loss.
7. In a class 3 apply to all wet surfaces. Charge for all of those surfaces, not just floor footage.
8. Apply to the floor from underneath in a crawlspace or basement.

1.9.1 Negative Pressure Floor Drying Principles

Water intrusion into the wood is at the bottom, the edges and into the sub floor. This is the interface that we are trying to dry. Putting an air mover over the top isn't going to help. What we need is airflow between the hardwood and the subfloor. That is what negative pressure floor drying systems are for.

Components of the Negative Pressure Drying System

There are 2 components of a negative pressure floor drying system:

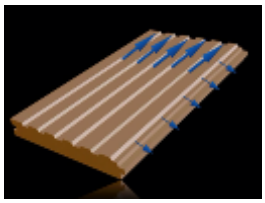
1. The vacuum pump

The vacuum pump is designed for continuous use. It creates a vacuum with enough strength, or static pressure, and CFM to create the airflow needed for drying.

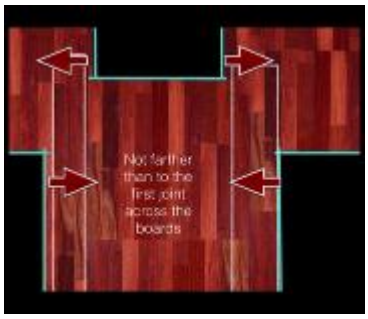
2. Panels to spread out the vacuum

The Panels are simply there to spread out the vacuum to a larger section of the floor. They make a 1 1/2 vacuum line cover a large section of floor. That means that contrary to common belief it doesn't matter which direction you lay the panels. The key is understanding *where* to place those panels. In order to understand that we need to look under the floor so that we can figure out where these panels go.

Proper Panel Placement for Wood Floor Drying

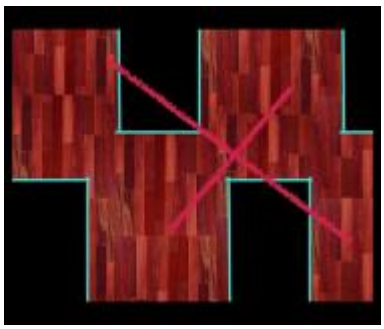


Air moves along the length of the board (up to 3') and between the boards, but will not move across the boards.

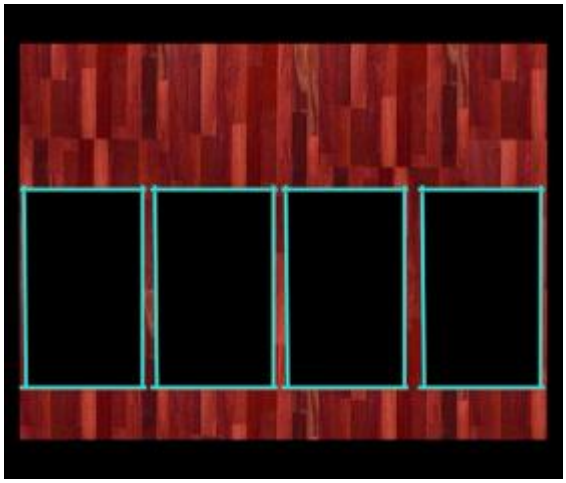


This helps us to see that we cannot have multiple boards between panels. We should have no more than one board between panels.

Don't just try to spread the panels evenly over the floor.



Proper layout should look something like one of the two examples below. Laying the boards parallel to the direction of the wood will cover less floor space than laying the boards perpendicular, but the floor will still dry.



1.9.2 Negative Pressure Floor Drying System Application for Wood and Ceramic Floors

When making application of negative floor drying systems getting the right setup of the panels is critical. Our purpose in this procedure is not to cover every detail of drying wood and ceramic floors but to show proper use of the negative pressure floor drying panels and systems.

Proper Panel Setup

2 critical principles for setting wood floor panels are:

1. Air will flow through the fluting under the boards up to 3' beyond the panels along the length of the boards. This means that down the length of the boards, panels may be placed up to 6' apart but no more than 3' from the perimeter of the water damage or the walls.

2. Air will not flow across or perpendicular to the direction of the boards. If there is more than one board joint between the panels you will not effectively dry the area between the panels.

(*Reference 1.9.1 for more detail)*

Number of Panels Per System

It is important not to use too many panels with one vacuum pump. If you do, this reduces the effectiveness of the entire system. The number of panels that you use is determined partly by the floor itself.

A wood floor that is badly cupped or has large gaps between the boards will allow more air escape from the drying system. This means that you need to reduce the total number of panels used per vacuum pump.

When a wood floor is not cupped very much and has very little gapping between the boards less air will escape from the drying system. You may use more panels per vacuum pump.

When using the Injectidry brand system you can use 5-8 panels per vacuum pump.

When using the Dry Force and Rescue Mats from DriEaz you can use 3-4 panels.

Installing The Panels

When installing the panels tape them to the floor. This limits leakage of the vacuum around the perimeter of the floor. Be sure to get the majority of the tape on the panel instead of on the floor. The tape will stick well to the floor but not as well to the panels.

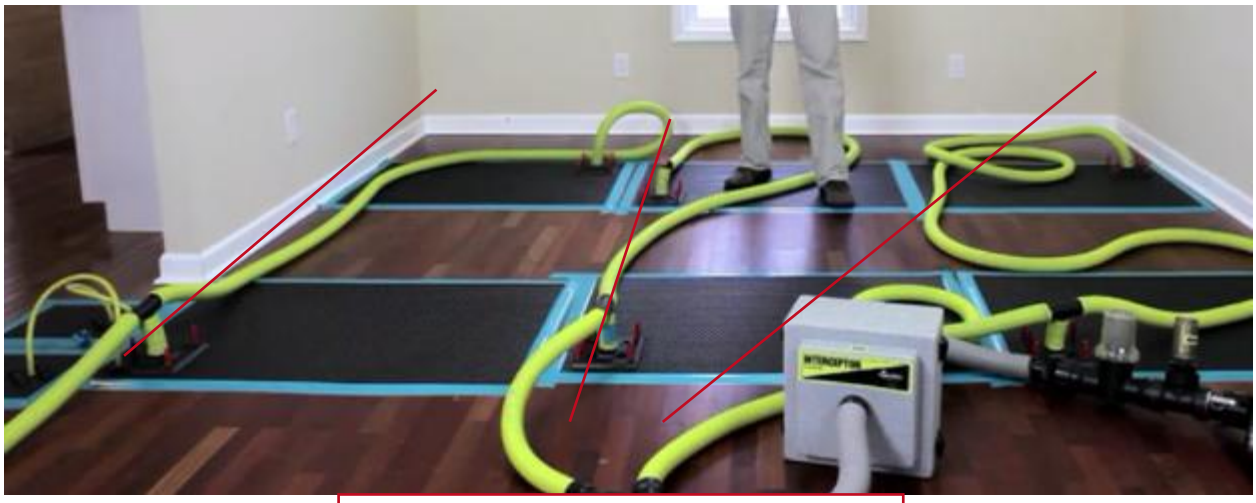
Taping the panels to ceramic tile floors presents a unique challenge, grout lines. These must be sealed so that vacuum is drawn under the floor as opposed to just leaking out at the edge of the mat. This is done by first placing a small piece of tape at each grout line and working it into the the grout line.

Then apply another piece of tape around the perimeter of the panel much like you would on a wood floor.

Properly Attaching Vacuum Lines

When attaching the vacuum lines they must be:

1. Sealed well at the panel. Any leakage here will negatively affect floor drying.
2. Attached to the floor in parallel, not in series.



Vacuum lines correctly run in parallel.

1.10.1 Containment Principles For Drying

Since water damages are environments that are humid and drying conditions are warm and dry, containment is commonly used in drying.

3 Reasons For Containment

The goal is to contain to the smallest area that is reasonably possible so that you can maximize the benefits of containment. There are 3 main reasons for containment:

1. **Speed**. By containing the hot, dry, airflow to the water you can speed drying.
2. **Efficiency**. The smaller the area that must be dried or heated the more effective your equipment will be.
3. **Control.** Containment creates a separation between the affected and unaffected areas.

2 Types of Containment

Traditionally there has only been one type of containment used in drying. This involves putting up plastic barriers or closing doors to separate one area from another. This is called *regional containment.*

With the advent of ETES and TES *direct containment* was developed. Direct containment means that the hot, dry, airflow is contained directed to the wet surface, this can be done by floating carpet or plastic or injecting air into wet walls. Direct containment is the most effective means of containment and should be used whenever practical.

Pressurization for containment

At times it is necessary to pressurize an area being dried to contain that area from the other unaffected areas. We are not discussing containment for mold remediation, just for containing drying conditions.

There are three possible pressurizations:

1. **Positive**. Add air to the affected area.
2. **Negative**. Remove air from the affected area.
3. **Neutral**. Same quantity of air being added and and removed from the affected area.

To create positive pressure, air must be added to the area. This can be done for example by keeping dehumidification equipment outside the room and ducting the process air into the room. This causes air from the drying chamber to be forced to the unaffected areas of the structure.

To create negative pressure, air must be removed from the area. This can be accomplished by placing a dehumidifier outside the room and ducting air from the room into the intake of the unit. This causes air from the unaffected area to move toward the drying chamber.

To create neutral pressure, there should be no difference between the amount of air added to or removed from the room. This is the most common pressurization as it can be established by placing the equipment inside the room being dried. Neutral pressure can also be created by placing the dehumidifier outside the room and ducting both the intake and process air to the room being dried.

1.10.2 Containment Application

There are two types of containment:

1. Regional
2. Direct

Regional containment is the most commonly used containment in drying. It basically involves separating one area from another. This can be done as simply as closing a door or may require putting up plastic.

Direct containment is the most effective means for containing hot dry airflow to the water. There are different situations where we might use direct containment. Use direct containment when possible for drying different types of flooring or by injecting hot dry airflow into wet walls.

Installing Regional Containment

Whenever it is possible the easiest way to do regional containment is by closing off areas using the doors that are already in place. When there aren't doors to use then plastic may be put in place using either containment systems like Zip Wall or double-sided tape.

Direct Containment Over Hard Surface Flooring

To contain a hard surface flooring area like hardwood, tile or concrete, start with four mil plastic laid over the floor and held in place by sandbags.
Stand the sandbags upright against the wall about every 3 to 5 feet. By standing sandbags upright you expose more of the wall surface behind the sandbag. If the sandbag were laid down parallel to the wall it prevents hot dry air flow from escaping from underneath the plastic up against the wall thereby extending wall drying times.

As you're placing the sandbags make sure that large wrinkles are pulled out of the plastic that is laying over the floor. If you don't take these wrinkles out the plastic will not float properly.

Once the sandbags and containment plastic are in place, inflate the containment using either a dehumidifier or an ETES or TEX box. This will supply hot dry airflow underneath the containment. You would not inflate this plastic with just an air mover because that will only provide the same air conditions available in the ambient air. It defeats the need for containment.

Direct Containment In Carpeted Areas and Wall Drying

Using carpet as direct containment assists in distributing hot dry air flow both to the subfloor and to the base of the wall. The best equipment for direct containment in this application is TES equipment.

Injecting hot dry air flow into wet walls is a great way to directly contained hot dry airflow to the water that is trapped in these interstitial cavities. This is really only necessary when there is a non-permeable coating on the walls that prevents us from drying from the outside surface of the wall or if there is wet batt insulation inside the walls. The more airflow you can provide into the wall the faster drying will take place. It is important not to disturb areas that you believe to be moldy with this process. If you suspect that there is mold growth in the wall cavity follow appropriate remediation process instead of trying to dry the wall board in place.

1.11.1 Securing Doors and Windows

During directed heat drying, drying with desiccant or fire board up, securing doors and windows becomes necessary. Our goal is to make the opening as secure as the window alone would be. Windows themselves are not that secure but certainly by putting plywood over the opening we have achieved our goal. Here's how to do that without damaging the building in any way.

When Weatherproofing Is Sufficient

If security is not an issue, using a Phoenix window adapter is sufficient. These are quick and easy to set in place. They work well for keeping wind and rain out and still giving us an entry point. These do not provide security from intruders.

When Security Is An Issue

Installing a plywood security panel attached using a 'sandwich' method of installation is the best option. Here are instructions for making them:

Start with a sheet of 1/2" plywood and a 2"X4"- 12' long.

Cut the plywood into 3- 3' X 2'8"? pieces. You will lose a 1'X8' piece as scrap.

Cut the 2X4 into 4 - 3' lengths.

Lay one of the 2X4 lengths across the center of the plywood. Trace circles that you will cut open to allow your ductwork to pass through. These openings must be either above or below the 2X4 that will hold the plywood panel in place. (Do not cut these openings if you want security panels that may be used to board up windows in a fire damaged structure.)

Choose 1 of the 2X4 pieces and drill 1/2" holes at 4" from each end. Use one 2X4 as the pattern for the rest of the 2X4s so that all of them will be the same.

Stack the 3 pieces of plywood. Take the 2X4 pattern and drill 1/2" holes through the plywood.

Install using 2 carriage bolts, with 2 nuts and one washer on each.

Installation of these panels is usually done from inside the structure so that a ladder is not needed. Hand tighten only the nuts only. Pull in on the panel to allow sufficient hand tightening. Over tightening can damage the window.

Securing Doors

The same type of panels may be sized for door openings (use 3/4" plywood for door openings), but it is preferred to use window openings if possible. On commercial losses door openings are often the only option.

1.12.1 Safety and Environmental Inspection

The inspection of a drying job is like its foundation. If the foundation isn't good the structure won't be either. In drying if you don't start with a thorough inspection you cannot have a good drying job.

The first concerns to address are safety and environmental issues and the water source. Once that is complete, find the perimeter of the water loss and identify complexities so that you can put together a project plan.

All of these are critical to starting a water loss that will be profitable and to protect you from unnecessary liability.

Safety Concerns

The first thing to address on any water loss is safety. Check for electrical hazards and slip and fall hazards. Any concerns should be addressed immediately so that all occupants are safe.

If water may have gotten into electrical connections call an electrician to make the building safe. When in doubt, have a professional check the building.

Identify the source of the loss. This needs to be done early in the loss. It would be unfortunate to be working in a loss under the assumption that the source was clean water, only to find out later that the source was contaminated water. Also good to make sure that water is not still coming into the building. Additionally, you need to confirm that the water damage is a covered loss if you and the customer are under that assumption.

Asbestos and Lead

Any building may have asbestos issues. There are two different sets of regulations that must be followed. There're federal regulations and then state regulations. The state regulations will be more stringent than the federal regulations. This makes it very important for you to be aware of what your state requires. When in doubt don't disturb materials that you suspect may contain asbestos or that may you may be required to test prior to disturbing.

As of the writing of this document federal lead regulations require that testing be done on all homes that were built prior to 1978. The opt-out option has been eliminated. Areas of concern include wood coatings and hardwood floor coatings. Any structure that is found have lead must be remediated according to current federal guidelines. The EPA estimates that 24% of homes built between 1960 in 1978, 69% of homes built between 1940 and 1960 and 87% of homes built before 1940 have lead in them. Depending on the area that you live in and age of the homes found there, lead may be a major concern for most of your inspections. Certain occupant notification requirements apply. Be sure to check current regulations.

Mold and Bacteria

Mold and bacteria amplification are also environmental concerns that must be addressed. The source of the water and the time that the water has been in the structure will affect bacteria and mold amplification. Often mold is a pre-existing condition. While there may be insurance coverage issues for mold, that does not affect the need to contain and subsequently remediate the mold that is found in the structure.
At a minimum do a visual inspection for mold as well as a sniff test. If you see or smell mold, address it.

Failure to properly identify and eliminate safety and environmental issues at the outset will negate any good that was accomplished in drying. It is wise to maintain a healthy fear of liability in this area. It will keep you diligent in making buildings safe for your customers.

1.12.2 - Photographing a Water Loss

In most cases an adjuster will not be at a water loss before you arrive. In many cases they will never see the property. It is up to you to tell the story, justifying the reason for the services that you have provided and identifying the damage that occurred. There is no better way to do this than through pictures.

The Camera

Selection of the camera and image quality is important. If images are too high quality then you can't store and send the photos easily. If images are too low in quality they are grainy. Cameras on phones can work if they take quality photos. The pro to a camera phone is that they give you many simple options for sharing pictures, but they often struggle in low light. A wide angle lens is very helpful for capturing the necessary photos.

Photograph Everything

There is no such thing as too many pictures. If there is any frustration it is that the picture you need is the one you didn't take. Or the image you needed to capture is just out of frame. For this reason it is important to follow a pattern for photographing a loss.

1. Take a photo of the job name first. You often take pictures of several different jobs in a single day. By photographing the name of the job first, you can quickly separate one job from another.

2. Take a photo of the front of structure. This is often requested by insurance companies, so have it available and include it with estimate.

3. Take photos in a specific pattern, start in a corner and photo down the wall working counterclockwise around the room. Finish each room with closeups of damage.

4. Take photos of equipment in place. This will require taking another set of photos but this time focus on the equipment. If you placed 15 air movers, make sure that you have photos of all 15 air movers.

Using The Photos

Some of the photos will be sent with the estimate. Don't send too many photos. You need to be selective so that the photos are meaningful. Attach descriptive photos to the estimate in key locations even using them to support certain line items. Include a photo of the front of the dwelling. Attach a few overview photos to familiarize others with the property. Finally include photos of anything info you need to convey without saying. (The property is cluttered, dirty, in disrepair, hoarding, etc.)

All of the rest of the photos should be kept permanently. You never know when you might need them.

1.12.3 Residential Pre-Inspection

When you're looking for where the water has gone or the perimeter of the water loss you can often be misled by the customer on accident. They will lead you to the area that they know to be wet although they may not know all the areas that have been affected by the water. It is your job to find the perimeter of the loss.

Perimeter Of The Loss

The perimeter of the loss is 3 dimensional. This means we must find the extent of the water intrusion up and down as well as side to side. It is very important to be thorough otherwise wet areas are missed and they will not be dry leaving you open for problems.

Areas are often missed when they are not shown to us by the property owner. You must be aware that you personally have to find extent of the water. Areas that are often missed include adjacent rooms where something may be sitting on the floor like a large piece of furniture, crawlspaces, unfinished areas, closets, and basements. These are missed simply because they were not obvious to the customer and we did not find the extent of the water both side to side and up-and-down.

In order to find the extent of the water keep looking side to side until the water stops or you reach an exterior wall. Interior walls do not stop water from flowing from one room to the other. When inspecting for water up-and-down water will continue to go down until it reaches the ground.

Complexities

There are a variety of complexities that you will run into including the following:

- Wall types and coatings
- Multiple layers of materials
- Chases and other inaccessible areas
- Moisture barriers
- Access and egress
- HVAC

To identify these complexities you must use visual inspections as well as an understanding of construction types that are common in your area in combination with your moisture meters to find these areas.

1.13.1 Scoping Basics

Insurance billing requires you to be very detailed in order to get the money that you need to perform the necessary services. This training is not designed to teach you how or what to bill. If you are working for insurance companies through program referrals the estimating standards that you have agreed to in those contracts will supersede any contradictions you may hear from me. Just because I suggest a way that you may choose to detail your services it does not mean that there are not exceptions or that no other options should be considered.

Our goal is to give you a scoping system that you can model after.

There are 3 components that you must have.

1. Diagram/ measurements
2. Scope sheet
3. Price list

Diagram or measurements

Accurate measurements are absolutely necessary for proper pricing totals. The best way to do this is to diagram a loss. Measurements should be measured down to the inch. Diagrams need to include all details of the loss site like walls, door openings and insets.

Scope sheet

- Reminder of services to provide.
- Quick way to record services provided.
- Helps expedite producing invoice for services.
- A detailed list of the services that you provided.
- May be used to create templates for all of the services that you must provide.

Price List

You must prepare unit pricing that is applied to the services provided.
Xactimate and Bluebook collect pricing data and publish the averages for different areas of the country.
Xactimate is also a very commonly used estimating system that many of you likely use.

1.13.2 Diagramming a Loss

Diagramming is an important skill in water restoration. You cannot be too good at diagramming. A diagram can be a great way to tell the story of a water loss. If you have never stepped foot on a particular loss a diagram gives you a picture of what it looks like. It helps to give you perspective of the loss. It also gives a you great way to label rooms, add measurements and draw affected areas in. You may also use your diagram for moisture mapping.

It is critical that diagrams be accurate. If the measurements are incorrect the pricing will be incorrect. If pricing is increased due to the error it may appear as if you were attempting to deceive or be dishonest as this is a common practice among unethical restorers. Since the measurements on the diagram are what pricing will be based on, spending a little extra time and understanding the process for diagramming a loss are extremely important.

There are 3 components of any diagram:

1. A drawing of the foot print of the loss.
2. Room Labels
3. Accurate measurements

How to Diagram

1. Start with an outside wall using a pencil
By starting with an outside wall you give yourself a stable point to work from. This makes it dramatically easier to make an accurate drawing.

2. Determine how to scale the drawing for the space that you have.
Look at the size of the loss and compare that with the size of the paper that you're working with. In order to get perspective it is good to put more than one room on a sheet of paper. Size your rooms accordingly in the drawing so that they will fit on a single piece of paper or as few sheets as possible.

3. Look for walls that line up so that your drawing will work at the end.
A proper diagram should fit all the rooms together just as they actually do in the structure. It is very helpful to identify common walls or walls that follow a common line throughout a number of different rooms. This will make your drawing line up properly as you add rooms. There are tools such as Line Designer pads and rulers that will make it easier to draw clean diagrams.

4. Label the rooms
The room names that you use throughout the job documentation should be consistent. Label the rooms on your diagram the same as you will on the estimate and the scope sheets that you're using.

5. Insert accurate measurements
Measurements should be to the inch not just to the foot. The old adage 'measure twice, cut once' can be applied to diagramming as 'measure twice, draw once.' Make sure to include accurate measurements for difficult areas such as bay windows, stairwells and

1.13.4 Creating A Pricing System

There are a few key elements to a pricing or estimating system for water losses:

1. A proper scope that follows a consistent system
2. Line item pricing
3. A system for combining the scope of work with the appropriate prices.

We have discussed in some detail the way to develop a scoping system including a scope sheet to bring consistency to your water losses.

Pricing should be created so that it reflects market conditions and your desired profit margins. There are some resources that report pricing data for your area and these can assist you in setting prices.

Pricing Systems

There are several systems for pricing a water loss such as Xactimate and BlueBook. If you are not ready to invest in such systems you need a quick easy way to create a bill. Depending on where you live you may experience flooding that is not covered by insurance. In this case the customer needs a price before you start. This means that you need a fast, easy, accurate way to create a total price. You need a pricing system.

If technicians are going to create the bill it is best to use the same system that they use for scoping. The system that we are providing gives techs the ability to create a scope and gives the business owner the ability to insert prices. In this way a bill can be created onsite in a no more time than a standard scope. Our system is built on the same scope sheet that we use on other scopes.

Setup Up Of Pricing System

The first thing that you must do with our sheet is insert pricing on the pricing tab of the spreadsheet. This pricing should reflect market conditions and your desired profitability. Once the pricing is set, resave the sheet as your master pricing sheet. Each time you want to use this sheet you must create a new file or do a 'save as' so that you do not change your master sheet. Pricing should be reevaluated periodically.

Use In The Field

In order to use this system the person in the field needs a computer, tablet or smart phone. For the iPhone, iPad, iPod Touch you need the Numbers App from the Apple Store. Then use the Numbers version of the scoping file. You may also download an Excel compatible App and use the Excel version of the file. For PC, Android and Windows mobile devices use the Excel version of the file and open the file with Excel or an Excel compatible program.

It is best to break down the estimate by area and then list the services, demo and equipment used in each area. This makes it very simple for the customer to see how the bill was created and what services were provided.

Pay close attention to the unit of measurement being used. Some services are priced by the square foot and others by the linear foot and still others are charged by 'each'. If the 'each' units do not fit the given job then you may increase the number you insert in the cell. For example, Contents. Our sheet only states one size. If there is an extraordinary amount of contents, then either insert 1.5 or 2, or add hourly labor at the bottom of the sheet.

Equipment is a combination of the number of units plus the number of days used. The days are traditionally figured by the 24 hour period and not the calendar day.

Emergency service calls and other services may need to be added. This will depend on your pricing strategy. Have a set policy that is clear to all technicians.

Usually it is wise, if possible, to have the technician send the pricing sheet to a supervisor for review prior to presenting to the property owner. This will depend on the technology that the tech has available in the field.

1.13.5 - 3 Virtually Instant Ways To Improve Water Damage Scopes

Water damage scopes give the basis for your water damage bill. They also document the processes that were used on a particular job therefore either limiting or exposing you to liability depending on their quality. Improving water damage scopes is very important to a successful company.

3 Ways To Improve Scopes

Use A Scope Sheet
Review Price List and Descriptions
Scope By Deletion Instead of Addition

Use A Scope Sheet
By using a scope sheet you bring consistency to the scopes that are prepared. This improves estimating accuracy as well as efficiency. It also serves to remind technicians of the services that are necessary while giving them a simple way to report services rendered.

A scope sheet also improves the reporting process. As services are provided and they are reported profitability increases and liability is reduced. When services are provided and not reported they won't be charged for. Additionally if an issue arises on that job in the future it may appear that proper process was not followed opening your company up to unnecessary liability.

Review Price Lists and Descriptions
If you are using an estimating program like Xactimate it is very important that you regularly review the price lists as they are continually updated. These updates may include new line items that better represent the service that you provided. Some of the line items that you have used in the past may change a bit in their description as well and may not represent the service you provided. To prevent problems review new price lists as they are released.

It is also important to review the description of the line items you are using as they may direct you to also use an additional line item to complete the charges for a service you are providing. These additional line items may be necessary to properly represent the costs associated with your services.

Scope By Deletion Instead of Addition
Just as you prepare a grocery list before you go to the grocery store so that you don't forget items, it also helps to create service templates for technicians. This includes identifying the services that you want provided on each type of loss as minimum service requirements. It is best to use the scope sheets that you currently have and highlight the services that must be performed. This helps to be sure that the most important services are not forgotten.

1.14.1 - Handling Contents On A Water Loss

The personal property in a home is most often more valuable than individual parts of the structure. They definitely have more sentimental value. It is important that we address personal property with the proper level of professionalism.

We need to handle contents in a manner that demonstrates to the customer that we respect their belongings and protects them from damage.

Moving Furniture

The less furniture there is in the drying chamber the easier the job will be to manage. Each day the furniture that was left in the drying chamber on wet flooring must be moved to completely dry the areas under the furniture.

Where practical move small pieces out of the affected area while leaving larger pieces in the rooms being dried.

Carefully look over the furnishings that need to be moved. Examine the feet or legs of the furniture. Are they in good enough condition to be moved without breakage? Is there preexisting damage on the items being moved? If so, document that with photographs.

Don't adjust your level of care for the furniture that people have in their homes based on the value. If the furniture is low quality it is susceptible to breakage. If it is of high quality any damage will be costly to repair. All furnishings must be handled with care.

If there are any items on top of the furniture remove them before moving the furniture. Remove drawers if they have a lot of weight in them. Before opening drawers, get permission from the homeowner.

Protect Furniture

Whether you are keeping furniture in the area that is being dried or must move it to another area, the legs need to be protected every time. If the legs of the furniture are wet you don't want to stain floor coverings in an unaffected area.

Raise furniture off of wet flooring using either foam blocks or plastic tabs. Use blocks on furniture with larger feet that the plastic tabs cannot cover.

1.15.1 PPE on Water Losses

The goal of this section is not to cover all applications or regulations dictating proper use of PPE but rather to convey the importance of using PPE. Personal Protective Equipment (PPE) is designed to reduce the opportunity for injury and exposure to hazardous environments. Working on water losses can be a hazardous environment when contaminates are present. Losses which are affected by Category 2 and 3 water, mold or other contamination would require the use of proper PPE.

Occupational Safety and Health Act (OSHA) Standards detail the federal standards for safety and protection of workers. The standards found in 29 CFR 1910 and 29 CFR 1926 contain most of the applicable standards for restorers. States may create more stringent standards that must be followed. It is required that you be aware of and in compliance with all federal and state regulations.

PPE should protect you from contaminates in four ways:

1. Dermal - skin protection
2. Inhalation - breathing protection
3. Ingestion
4. Mucous membranes - eyes, nose and mouth

Dermal

Your skin should be protected from contaminates that you encounter. This would commonly include wearing items such as gloves, protective coveralls and boots.

Choose a waterproof glove, preferably with a long cuff. Gloves tear regularly when you are working so be prepared for that. Add a second glove over the top of the first. Another heavier waterproof glove or leather glove will give added protection.

Coveralls should include a hood and for most applications should include a shoe cover. Choose waterproof suits for Category 2 and 3 water losses. When addressing mold only a breathable suit is preferred. A waterproof boot, either disposable or reusable, should be worn also.

Inhalation

Air is often contaminated in the environments that we are working in and therefore you must wear appropriate PPE to protect you.

There are many types of respirators designed for different levels of protection. Choose a particular manufacturer and stay with them. It makes it easier to determine which type of respirator and cartridge will be needed for the type of contaminates you may be exposed to. You can stock one brand of cartridges and replacement parts and they will work with all of your respirators. The manufacturer will also be able to provide information and assistance on fit testing, medical clearance requirements, proper maintenance and written respiratory protection plans which are all required to meet federal regulations.

Follow all manufacturer and industry guidelines and federal regulations for the proper use of respirators.

Ingestion

Prevent ingestion of mold and unwanted bacteria on water losses. Wearing a respirator can protect you from splashing of Cat 2 or 3 water. While not PPE, safe work habits are important in this area. A few of these could include: Do not eat or drink in contaminated areas; do not eat without first removing PPE; and wash your hands immediately after removing gloves.

Mucous Membranes

Nose and mouth are protected by using a respirator. Protect your eyes with goggles or a full face respirator. Goggles may be either vented or non vented. Vented goggles only protect you from splashes and not airborne contaminates. Usually non vented goggles or a full face respirator would be chosen for the contaminates found in water restoration projects. Application of an anti-fog solution to the lens of non vented goggles is helpful.

Use PPE

While PPE is not comfortable it is designed to protect you. Wear it. Do not allow fellow employees to work without proper PPE. If another employee refuses to wear proper PPE report this immediately to your supervisor.

For more information on safe work practices in water damage environments, see Chapter 9: Safety and Health of the IICRC Reference Guide for Professional Water Damage Restoration (IICRC S500).

See *2006 IICRC Reference Guide for Professional Water Damage Restoration (IICRC S500)* p. 169, 170 for industry guidelines on the use of respirators.

1.16.1 Wall Air Injection Tools

There are a few situations that will force us to dry a wall from the inside as opposed to the outside. The drying principle is hot, dry air flow to the water.

If a wall has a non permeable coating like wallpaper or several coats of paint we must dry from the inside of the wall. For a wall that has batt insulation inside that is wet, injecting air into the walls will speed the rate of evaporation. Another situation would be a plaster wall with wood lathe that is wet. Drying from the inside of the wall in these situations will prove to be much more effective than drying from the outside surface alone.

When you are injecting air into walls you will primarily be using positive pressure, pushing air into the walls. Some people will suggest that using negative pressure on a wall, pulling air out of the wall, will keep from spreading contaminants throughout the structure. If you believe that there is contamination such as mold inside the wall, remove the wall before drying. There is no reason to dry a wall that has mold in it since it's going have to be removed anyway.

Air Injection Tools

There are two types of air injection equipment:
1. High-pressure low-volume
2. Low-pressure high-volume

High-pressure low-volume equipment has the advantage of being able to use small tubes. These small tubes mean that you need drill only small holes. Sometimes this is an advantage because it makes it easier to repair the wall that you are attempting to dry. As the name suggests there is less air volume using this type of equipment so typically drying is slower than with a high air volume unit. If keeping the holes small is necessary for the drying environment you're working in, high-pressure low-volume systems are the right choice.

Low-pressure high-volume equipment has the advantage of higher airflow. Higher airflow is going to speed evaporation more than a low-volume unit. Additionally you can attach some systems to a heat source such as ETES to increase vapor pressure differentials. The trade-off is that you need to drill larger holes for the tubing or nozzles that inject the airflow into the wall. Both tools serve a very important role in the drying process. The technician can make the decision as to which one is more appropriate for the situation at hand.

Air Injection Principles

Is it necessary to open the wall at the top to allow ventilation? The answer depends on where the water is. If the wall is wet from floor to ceiling then an opening will need to be made at the ceiling level so that air can flow out of the wall. This will allow air to flow through the entire wall cavity. Some walls may have blocking (framing running horizontally in across the wall cavity) in them. This will prevent air from flowing freely through the wall cavity. When this is the case it will be necessary to inject air into the wall above and below the blocking.

For walls that are only wet near the base it is not necessary to open the wall at the ceiling level. Injecting air at the base of the wall will create enough turbulence and air exchange to dry the base of the wall.

Psychrometry is the study of the relationship between air and water vapor. This study can help restorers to analyze conditions during drying.

2.1.1 Psychrometry 101 Relative Humidity and Specific Humidity

Definitions

A **Psychrometric Chart** shows the relationship between air volume, temperature and relative humidity. It helps you to determine a variety of specific humidity measurements.

Relative Humidity in the amount of moisture in air expressed as a percentage of the saturation point of the air. It is 'relative' to the temperature of the air.

Specific humidity is a measure of the amount of water in the air by volume. The most common measurements used in water restoration are vapor pressure, dew point and grains per pound.

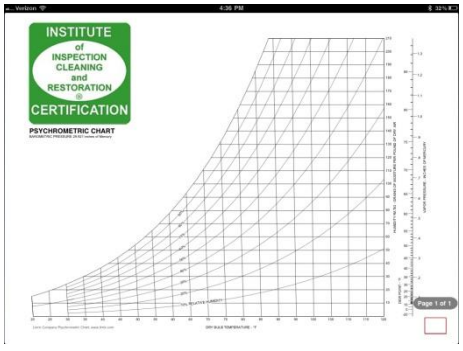
Need for Psychrometry

The restorer's job involves speeding up drying and documenting the process. Psychrometry is important in both of these as it is the study of the relationship between air and water vapor allowing you to analyze and record air conditions during drying.

Relative Humidity and Specific Humidity

Specific humidity tells you how much moisture is in the air by volume. The most common units of measure for specific humidity are dew point, grains per pound and vapor pressure. These units of measure work similar to the way measurements like ounces or milliliters work for liquid, specifically how much water is in the air. Just as putting 8 ounces of water in a bottle would still be 8 ounces of water regardless of the temperature of that water, a specific humidity of 54F dew point is still 54F dew point regardless of the temperature of the air. Specific humidity can be helpful in providing information such as whether a dehumidifier is removing moisture for instance.

Relative humidity changes with temperature as it is a percentage of the saturation point of the air. (Think 1/2 a bottle of water being 50% relative humidity.) As the air warms, the saturation point of the air increases and the relative humidity drops. (8 ounces of water is 50% of the capacity of a 16 ounce bottle of water, but only fills a 32 ounce container to 25% of capacity.)



Using a Psychrometric Chart

Using a psychometric chart you can convert air temperature and relative humidity to specific humidity. To use a psychrometric chart take a temperature and relative humidity reading of the air. Find the air temperature at the bottom of the psychrometric chart. Follow a straight line up the chart to the relative humidity line sweeping across from the left. Where the temperature and the rh intersect go straight across to the right hand side of the chart and you will see the specific humidity of the air in the units of grains per pound, dew point and vapor pressure.

2.1.1 Psychrometry 101 Challenge Question

If you have an environment that is 70F and 50% rh and you raise the temperature of the air to 100F, will evaporation occur faster or slower?

Answer:

Neither. The rate of evaporation is unaffected by change in air temperature alone.

There are only 2 ways that you can affect vapor pressure differentials which are drivers for evaporation:

1. Increase water temperature to raise water vapor pressure or decrease water temperature to lower vapor pressure. This would be indicated by a change in the temperature of the wet surfaces.

2. Reduce specific humidity to speed evaporation or raise specific humidity to slow evaporation.

Since we just changed the temperature of the air to 100F, (the relative humidity will change to about 19%) the vapor pressure will remain unchanged at 1.24 kPa since there will still be the same amount of water in the air.

2.1.2 Psychrometry 102 Specific Humidity Readings

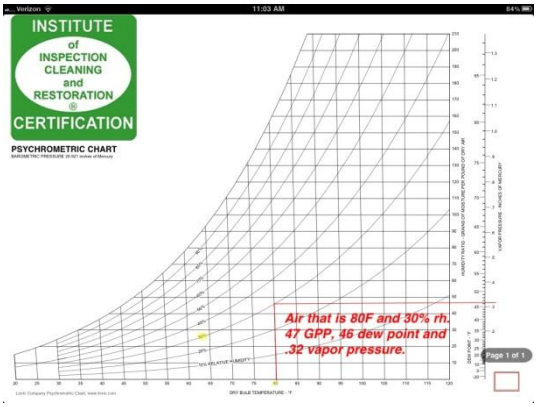
Definitions

Specific humidity is a measure of the amount of water in the air by volume. The most common measurements used in water restoration are:

Vapor Pressure is the pressure exerted by a vapor on its surrounding environment. Vapor pressure is also measured in liquid at the water temperature and 100% rh.

Dew Point is the temperature at which humidity in air reaches saturation and will condense on surfaces. Surfaces that are *cooler* than dew point will condense moisture and surfaces *warmer* than dew point will evaporate water from the surface.

Grains Per Pound (GPP) is a unit used to measure specific humidity or weight of moisture in air (7000 grains equals one pound of water or approximately one pint)



How to Calculate

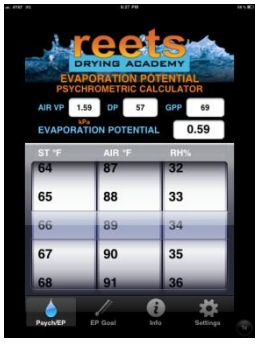
Psychrometric Chart

In order to calculate specific humidity a number of tools may be used. During an IICRC water restoration class you will be asked to use a Psychrometric Chart. You use this by taking the temperature and the relative humidity of the air and crossing to the specific humidity measurements. (This form can be printed from ReetsTV.)

Psychrometric Calculator Wheel

A Psychrometric calculator is often used on site to calculate GPP and dew point. It is limited in that it does not calculate vapor pressure. You simply align the temperature of the air with the relative humidity of the air and the calculations are shown in the boxes within the calculator.

ReetsDryCalc

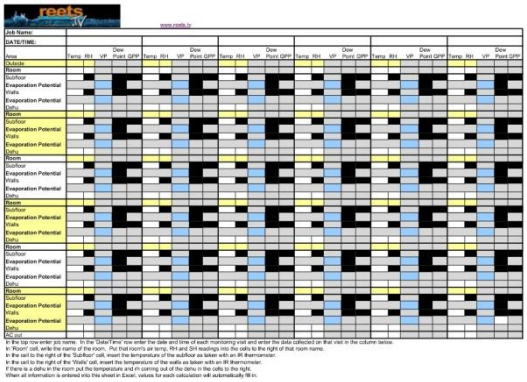


This is a smart phone app that does all of the calculations based on temperature of the air, relative humidity of the air and surface temperature. It will calculate GPP, dew point, vapor pressure and evaporation potential. (A link to this app can be found at ReetsTV.)

Hygrometer

The readings for air temperature and relative humidity are taken with a hygrometer. Make sure that when you take readings with a hygrometer you allow the meter enough time to acclimate or adjust to the environment you are in. This may take from a few seconds to several minutes based on the model you are using. Watch the numbers on the meter. When they stabilize (although they are changing slightly they are not continuing to either rise or fall) record the temperature and relative humidity. If the meter that you are using does not calculate specific humidity then calculate for specific humidity with one of the above tools.

Recording Psychrometric Readings

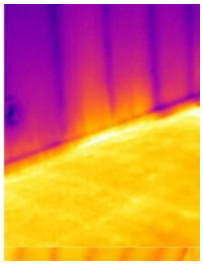


Specific Humidity readings must be both calculated and recorded on every job. A job is not complete unless these readings are documented. A generic form is available at ReetsTV. On that form record the following 3 items:

1. temperature of the air,
2. relative humidity of the air and
3. specific humidity calculations.

2.2.1 Hot, Dry Airflow to the Water

Drying can seem difficult because there are so many things to remember. Keep this in mind though: All drying is motivated by the same factors. Those factors are summarized by Hot, Dry Airflow, to the water. Those 4 items will dictate the quality of the drying environment that you have established. If there is a drying problem, it will boil down to one of these factors, always!



Hot –Heat the surfaces that are wet and you heat the water at that surface. This increases the vapor pressure of that water which helps speed drying.

Contain heat to the wet surface since it wants to rise and the water seeks the lowest level.

Dry – Dry the air at the wet surfaces. Lower the specific humidity or the vapor pressure of the air at a wet surface. Dry the air as much as possible to speed evaporation.

This is done using dehumidification or ventilation to remove some of the water from the air.

Air Flow – Move air over the water to speed energy transfer into the moisture. Just like blowing on coffee that is too hot speeds the cooling process, speeding air flow in a drying environment warms surfaces that are evaporating and therefore cooling.

Air flow is a multiplier of vapor pressure differentials according to Dalton's Law of Evaporation.

To The Water – Get the hot, dry airflow as close to the water as possible. This means eliminating moisture barriers and unnecessary layers of materials. The closer you get these elements to the water, the faster evaporation will occur. If there is a moisture barrier, evaporation will not occur. Think of a pot of boiling water with the lid on it.

By improving one or any combination of the above causes, you will improve your drying environment. For a better understanding of how to measure Hot and Dry, look at the Evaporation Potential systems in our manual.

2.3.1 Evaporation Potiential 101 - Dalton's Law of Evaporation

Definitions

Evaporation Potential a formula developed by Jeremy Reets from Dalton's Law of Evaporation. It gives us a value of the difference between the vapor pressure of the water and the air. It is expressed as a formula: EP = S(urface Vapor Pressure) - A(ir Vapor Pressure).

Vapor Pressure - A measure of a substances propensity to evaporate. It increases exponentially with an increase of liquid temperature.

Need for Evaporation Potential Formula

The restorer's job involves speeding up drying and documenting the process. We remove water through three processes: Extraction, Dehumidification and Evaporation. Evaporation is the slowest of the three. Evaporation Potential helps restorers evaluate the effectiveness of the drying environment in creating evaporation.

Psychrometry is an evaluation of the relationship of humidity and air. Evaporation Potential takes the next step and evaluates the relationship between the vapor pressure of the air and the water. With this information you can determine the potential for evaporation.

Dew Point

Dew point is a specific humidity measurement that indicates the fail point for evaporation. Surfaces that are warmer than the dew point of the air evaporate and surfaces colder than the dew point of the air condense moisture.

Dalton's Law of Evaporation (1802)

Expressed as a formula:

$$E = W(Pw - Pa)$$

E - Evaporation Rate

W - Wind

Pw - Vapor Pressure of the water

Pa - Vapor Pressure of the air

Tells us that we need to do three things to speed Evaporation:

1. Provide as much air flow as possible.
2. Increase the vapor pressure of the water as much as possible by heating it.
3. Reduce the vapor pressure of the air as much as possible by dehumidifying it.

High Pressure Moves To Low

By reducing the air vapor pressure and increasing the water vapor pressure we encourage evaporation. The greater the difference between the vapor pressure of the air and of the water, the faster evaporation takes place.

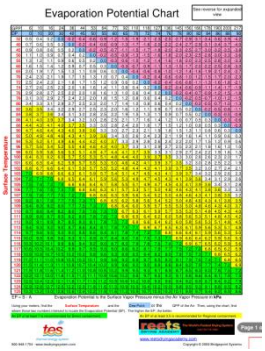
This difference is what Evaporation Potential measures. The greater that Evaporation Potential (EP) number is, the faster evaporation takes place. Evaporation Potential clearly tells us when the air is dry enough and the surface is warm enough.

2.3.2 Evaporation Potential 102 - Calculating EP

Taking The Readings

Take GPP or Dew Point readings with a thermal hygrometer. Take these readings in the air adjacent to the wet surface that you are going to evaluate.

An IR thermometer gives you surface temperature which is also the temperature of the water on that surface. Take surface temperature readings of any wet surface that you want to evaluate.



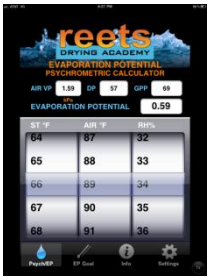
Using An EP Chart

Find the GPP or the Dew Point (DP) in the top row of the EP chart.

Find the surface temperature on the left column.

Where the row next to the surface temperature and the column down from your specific humidity intersect is the EP of your drying environment.

A negative number indicates condensation. A positive number indicates evaporation. The greater the number the greater the potential for evaporation.



Reets Drying iPhone App

If you have an iPhone, iPad or iPod Touch download the Reets Drying App from the Apple Store. It will calculate EP if you have air temp and RH as well as surface temperature. Dial these numbers in and it will calculate EP as well as psychrometric values.

Exercises

Find the evaporation potential of the following scenarios:

The air adjacent to the wet surface is 70/23% or a 30F Dew Point. The surface temperature is 55. EP_____

The air adjacent to the wet surface is 90/44% or a 65F Dew Point. The surface temperature is 70. EP_____

(The correct answers can be found on this ReetsTV Episode.)

EP Goals

Conventional Drying - LGR Dehumidifiers and Air Movers

EP Goal 1.5 or greater

Direct Heat Drying - TES or ETES, Air movement and Dehumidification or Ventilation

EP Goal 3.5 for Regional Containment

EP Goal 7 for Direct Containment.

2.3.3 Increase EP By Heating Wet Surfaces

Evaporation Potential (EP) measures the difference between the vapor pressure of the water and the vapor pressure of the air. An increase in Evaporation Potential brings an improvement in drying conditions. One way EP can be increased by heating water which increases its vapor pressure.

Effect Of Heating Water

The change of vapor pressure in a liquid can be seen on a psychrometric chart. The temperature of the water must be determined. This can be done with an IR thermometer.

In order to determine the vapor pressure of the water find the water temperature at the bottom of the chart and trace up to 100% relative humidity. Liquid is always at 100% rh. Then trace directly to the right out to the vapor pressure value. As the temperature of the water increases the vapor pressure increases. It is this increase that is the measure of increase of EP.

Ways To Calculate

EP can be calculated using an EP chart, a psychrometric chart or the ReetsDryCalc available on the Apple App Store.

Meet EP Goals

The EP numbers don't really tell you much unless you set goals with them. When you set goals they become a very specific target that you can engineer a drying system to meet.

If you are doing Conventional Drying with LGRs and air movers, your minimum EP is 1.5. You can run that number up into the mid 2's before you reach the outside limits of the LGR units.

If you are doing Directed Heat Drying with TES or ETES, your minimum EP is 7. This number can only be achieved if you are using direct containment.

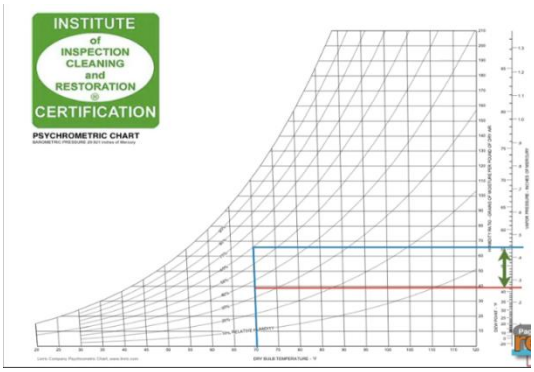
If you are below your minimum goal, one way to increase the EP is to heat the wet surfaces. In order to see how much to heat those surfaces look at an Evaporation Potential chart and move down the chart from your current conditions until you reach your goal. This will tell you how much heat to add to the wet surfaces in your drying environment to achieve your goal**.**

2.3.4 Increase EP By Drying The Air

Evaporation Potential (EP) measures the difference between the vapor pressure of the water and the vapor pressure of the air. An increase in Evaporation Potential brings an improvement in drying conditions. One way EP can be increased is by drying air, which decreases its vapor pressure and creates a larger difference between the vapor pressure of the water and the air. You want higher vapor pressure in water and lower vapor pressure in air.

Effect Of Drying Air

The change of vapor pressure in air can be seen on a psychrometric chart. It is important to note that there are different units of measurement for vapor pressure. The chart on this page measures vapor pressure in inches of mercury and the Evaporation Potential Chart measures in kilopascals. This is similar to the difference between using miles per hour and kilometers per hour. They measure the same thing in different units.



Using a thermal hygrometer determine the temperature and relative humidity of the air. This gives you the basic information needed to make the calculations necessary to determine the vapor pressure of the air.

Finding the vapor pressure of air on a psychrometric chart is the same as finding GPP or Dew Point. In the case of the psychrometric chart at the right you find the air temperature at the bottom. Move up the chart till you intersect the relative humidity which is indicated by lines curving up and to the right. When you intersect the relative humidity line go directly to the right until you reach the Vapor Pressure line at the right. As you dry the air the vapor pressure will decrease. It is this change that causes an increase in EP.

Ways To Calculate

EP can be calculated using an EP chart, a psychrometric chart or the ReetsDryCalc available on the Apple App Store.

Meet EP Goals

If you are doing Conventional Drying with LGRs and air movers, your minimum EP is 1.5. You can run that number up into the mid 2's before you reach the outside limits of the LGR units.

If you are doing Directed Heat Drying with TES or ETES, your minimum EP is 7. This number can only be achieved if you are using direct containment.

When you are below your minimum EP goal, use the Evaporation Potential chart to determine how much you need to dry the air to meet your goal. It is important to use EP to determine the need for drying the air because using GPP alone will not give you enough information to answer this question. Additionally it is often necessary to use more dehumidification than is recommended by the initial recommendations laid out by the S500. EP calculations will accurately identify this need.

There are 3 ways to dry the air:

1. LGR dehumidifier - These dehumidifiers have the capability to reduce the air to 34 GPP or 0.77 VP in kilopascals.
2. Desiccant dehumidifier - A desiccant can reduce the humidity even lower than a LGR, but it needs to start with cool, dry air to achieve that.
3. Ventilation - This can be used any time the outdoor air is drier than the inside air. It is most commonly used when doing directed heat drying because ventilation removes both excess heat and humidity. The humidity of the air inside the drying environment cannot be reduced to less than the humidity of the outdoor air since the outdoor air is what is being used for humidity reduction.

2.3.5 Drying With EP

Documenting a water loss properly tells the story, limits company liability and that of the insurer and justifies decisions regarding equipment usage on a water loss. If documentation is done improperly or incompletely the opposite occurs. Liability is unnecessarily generated for the company and there is no justification for the equipment that was used on a water loss. This creates significant financial impact on the company.

Documenting EP

The use of GPP as the sole means for documenting a water loss is not sufficient. Specific humidity cannot identify the ability of a surface or a drying environment to create evaporation. While documenting air conditions *only,* and primarily GPP, to record drying conditions is a standard practice, it should be avoided.

Job Name:							
DATE/TIME:	1-1 11:23 A						
Area	Temp	RH	Vapor Pressure	GPP	Temp	RH	Vapor Pressure
Outside	45	62	0.63	27			
Room Basement	75	44	1.39	57			
Subfloor	66		2.17				
Evaporation Potential			0.88				
Walls	73		2.77				
Evaporation Potential			1.47				
Dehu	108	11	0.91	40			
Room							
Subfloor							
Evaporation Potential							
Walls							
Evaporation Potential							
Dehu							

The documentation that is shown here provides complete information. Surface temperatures have been recorded in addition to air conditions. EP calculations should be included as shown. If you use the Reets Drying Documentation Form in Excel it will make the desired calculations as the data is supplied.

The EP Toolbox

There are only two tools that will change EP. The best drying environment management includes both tools, heating the water *and* drying the air to achieve the desired EP goal:

1. Heating the water

TES and ETES Direct Heat Application equipment: Can raise surfaces to 115 to 120F if desired.

HVAC: May warm surfaces to as much as 85F, but will require heating the entire building to that temperature which may not be desirable.

LGR Dehumidifiers: May increase surfaces to as high as 85F. High Temp LGR's may raise surfaces to as high as 110F.

Air Movers: When air is warmer than the surface, air movement will transfer energy into the water faster.

2. Drying the air

LGR Dehumidifiers: may remove some moisture from the air to as low as 34 GPP or 38°F dew point.

Desiccant Dehumidifiers: May remove moisture from air to a point lower than LGR's but must be drawing in cool, dry air to do so.

Ventilation: Can remove moist air from a structure very quickly, but not to a point lower than outside air.

2.3.6 - 5 Steps To Translating EP

While it is important to be able to collect drying data and convert it to EP, understanding what the results mean is where the value is held. When looking at drying data a professional can easily read what it says and know what to do about it. It is much like understanding another language. The numbers that you collect when documenting Evaporation Potential can tell you everything you need to know about drying that job.

When translating EP and making needed changes, professionals will utilize 3 things:

1. The conditions they can control.
2. The equipment they have to work with.
3. The change they can engineer.

5 Steps To Translate EP

This leads us to the five steps to translating EP, that is the ability to be able to read the drying data that you have and make sense of it.

1. Air temperature to best available, increase.

If using dehus, you need to keep air temp below 90F. If doing Directed Heat Drying, ambient air should be about 95F. Consider the needs of the customer when deciding air temps as well.

2. Humidity ratio to best available, reduce.

LGR dehumidifiers may remove some water from the air to as low as 34 GPP or 38F dew point. Desiccant dehumidifiers will remove moisture to a point lower than an LGR but must be drawing in cool, dry air. Ventilation can remove moisture very quickly from the drying environment but not to a point lower than that of the outside air.

3. Compare the subfloor temp to air temp, closer to the water.

Subfloor temperatures can be within a couple of degrees of the ambient air temperatures if you float carpet. When doing in place drying correctly, sub floor temperatures can range from 5 to 15°F less then the ambient air temperatures, depending on the season. Directed heat drying will raise surface temperatures significantly higher than ambient air temps.

4. Compare the wall temp to the air temp, increase air flow.

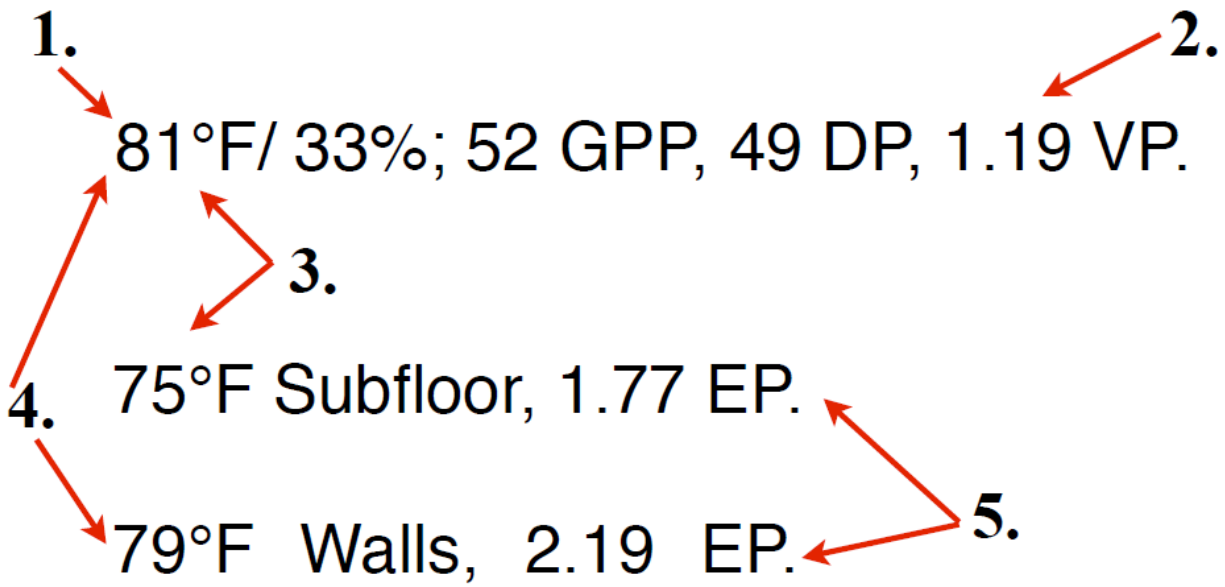
Airflow can help to bring ambient air temperatures and wall surface temperatures close together. Wall temperatures can be within 2°F of ambient air temperatures if there is sufficient airflow on them.

5.Check EP

After you've made adjustments, check to make sure that the changes you have made will be enough to achieve your EP goal. If not go back and attempt to maximize each element. If you still will not be able to reach your Evaporation Potential goal then let the interested parties know that drying times will be extended and why.

2.3.7 - Translating EP In Conventional Drying

A common mistake made by professionals is the belief that Evaporation Potential is used for directing heat drying only. The truth is without using Evaporation Potential in conventional drying it is impossible to clearly understand what is happening in the drying environment. When a restorer clearly understands how to take the proper measurements and understands what the language of drying, evaluation and adjustment a drying environment transforms from guesswork to tactical exercise.



The diagram above is designed to help you to visualize how to walk through the numbers.

1. **Air temperature** to best available, increase.
If using dehus, you need to keep air temp below 90F. Consider the needs of the customer when deciding air temps as well.

2. **Humidity** ratio to best available, reduce.
LGR dehumidifiers may remove some water from the air to as low as 34 GPP or 38F dew point. Desiccant dehumidifiers will remove moisture to a point lower than an LGR but must be drawing in cool, dry air.

3. **Compare** the subfloor temp to air temp, closer to the water.
Subfloor temperatures can be within a couple of degrees of the ambient air temperatures if you float carpet. When doing in place drying correctly, sub floor temperatures can range from 5 to 15°F less then the ambient air temperatures, depending on the season.

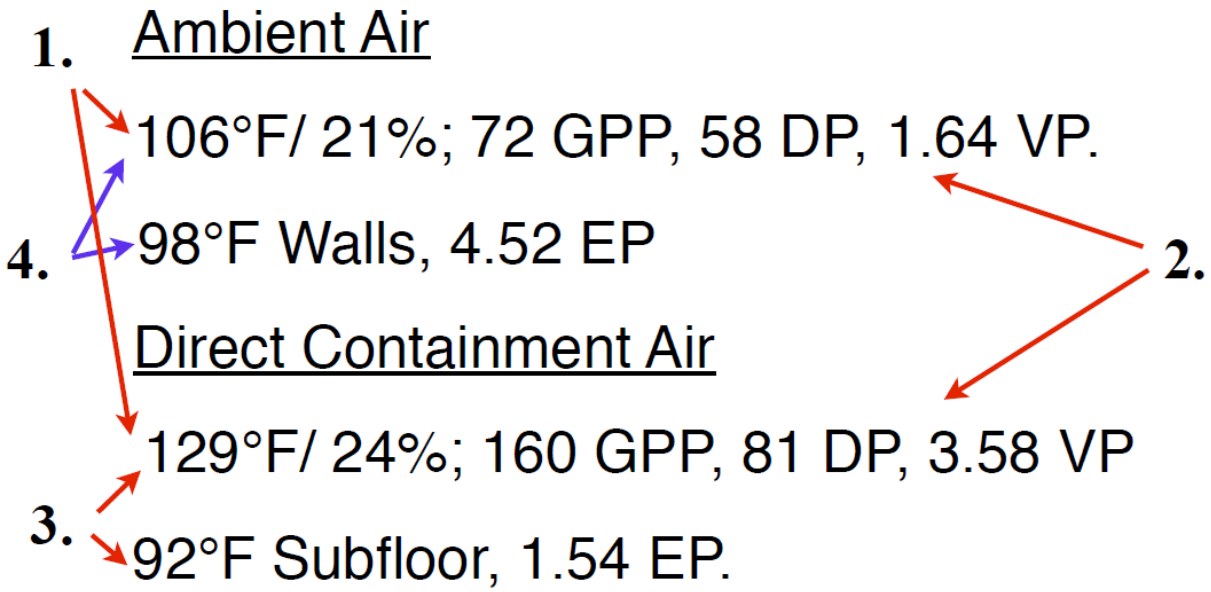
4. **Compare** the wall temp to the air temp, increase air flow.
Airflow can help to bring ambient air temperatures and wall surface temperatures close together. Wall temperatures can be within 2°F of ambient air temperatures if there is sufficient airflow on them.

5. **Check EP** *After you've made adjustments, check to make sure that the changes you have made will be enough to achieve your EP goal. If not go back and attempt to maximize each element. If you still will not be able to reach your Evaporation Potential goal then let the interested parties know that drying times will be extended and why.*

2.3.8 - Translating EP in Directed Heat Drying

When using directed heat drying, a common issue is consistency in drying. This is usually due to not understanding how to manage the conditions. By recording, calculating and translating EP, a professional can consistently bring superior results to directed heat drying.

You will notice that there is an additional air reading taken in directed heat drying. This is the direct containment air condition. Since we are floating carpet or plastic to get hot, dry airflow to the water, it is important to make sure that air is truly hot, dry airflow. This adds one more item that must be analyzed as we go through the list.



The diagram above is designed to help you to visualize how to walk through the numbers.

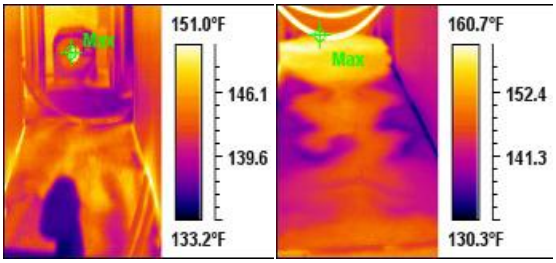
1. Air temperature to best available, increase. The ambient air should be within 5 degrees of the temperature of the thermostatic temperature control unit. If the temperature difference exceeds 5 degrees, then ventilation is not setup correctly. The standard setting for directed heat drying is 95F. The direct containment air should be about 15 - 30 degrees warmer than ambient depending on the TES or ETES unit you are using.

2. Humidity ratio to best available, reduce. The ambient air is dried by ventilating the hot, humid air from the drying chamber to the outside and replacing it with cooler, dryer air from outside. Ambient air will not be dryer than the outside. The direct containment air humidity is controlled by air flowing through the containment. If there is no venting at the corners of the room the humidity of the containment air will be elevated since the air is not being exchanged quickly.

3. Compare the subfloor temp to air temp, closer to the water. Subfloor temperatures can be within about 10-15 degrees of the direct containment air temperatures when you float carpet. If temperature differences between air and surface are greater than this, add more airflow or vent the corners to speed air flow across the wet surfaces.

4. Compare the wall temp to the air temp, increase air flow. Wall temperatures near the base of the wall should usually be warmer than ambient air temperatures since heat is being transferred to the walls from the direct containment. If walls are cool, add another air mover under the containment to

create more pressure under the containment and push the heat to the walls. See the two IR pictures. One is floated properly and the other is not. Can you see the difference?



5 .Check EP

After you've made adjustments, check to make sure that the changes you have made will be enough to achieve your EP goal. In directed heat drying the goal is 7 EP when you are doing direct containment. If you have not achieved your goal, go back and attempt to maximize each element. If you still will not be able to reach your Evaporation Potential goal then let the interested parties know that drying times will be extended and why.

2.4.1 Determining the Category of Water

It is critical that you be able to determine the category of water. Category of Water refers to the level of contamination in the water that is present on a water loss. The level of contamination in the water may be affected by three things:

3. Source - The contamination level of the source of the water damage will affect category of water when unwanted contaminants have been introduced.
4. Time and temperature - When time and warm temperatures are combined prior to the start of restoration, the microorganisms in a structure will amplify.
5. Cleanliness of the structure - When water mixes with an unacceptable level of contaminants already existing in the structure decontamination may be necessary.

The category of water assists the restorer in determining the necessity to decontaminate the water damaged structure as well as the level of protection that is required for both restorers and occupants.

Sometimes referred to as clean water, gray water and black water, categories of water in water restoration are more accurately referred to by number.[1] There are three categories numbered one through three. Category one is the cleanest water and category three is the most contaminated water.

Category 1
Category 1 water starts clean and remains clean to the point at which restoration begins.

1. Source - The source of the water is clean. Common sources would be broken pipes, appliance supply line failures and tub overflows.
2. Time and Temperature - Restoration began soon after the initial loss and temperature was not sufficient to amplify microorganisms to an unacceptable level.
3. Cleanliness – The structure is generally clean.

Category 2
Category 2 is contaminated water and has the potential to be unsafe for humans.

1. Source - Examples of Category 2 sources include toilet bowl overflows but without debris, and dishwasher or washing machine wastewater.[2] When combined with time and temperature and/or a dirty structure, Category 1 sources can degrade to Category 2 water losses.
2. Time and Temperature - If beginning restoration is delayed a few days and structure temperatures are warm, Category 1 water can degrade to Category 2 water loss.
3. Cleanliness - If the structure is very dirty and already has a high level of contaminants the water loss could be defined as Category 2.

Category 3
Category 3 water is grossly contaminated and is very harmful to humans.

1. Source - Examples of Category 3 sources include sewer backups, any water that comes from beyond the plumbing P-trap, rising floodwaters, groundwater, and storm surge.[3] Source could also be a Category 1 or Category 2 type of source that has degraded due to time and temperature and/or a dirty structure.

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[1] It is not the goal of this document to create a standard, rather to report a summary of the information contained in the *2006 IICRC S500 Standard Reference Guide for Water Damage Restoration.* See this reference source for more details on Category of Water.
[2] This is an abbreviated list of examples of source type. For a more complete list and definition see the *2006 IICRC S500 Standard Reference Guide for Water Damage Restoration*.
[3] This is an abbreviated list of examples of source type. For a more complete list and definition see the *2006 IICRC S500 Standard Reference Guide for Water Damage Restoration*.

2. Time and Temperature - If restoration is delayed several days and structure temperatures are warm, water can degrade to Category 3 contamination level.
3. Cleanliness - If the structure is very dirty and has a high level of contaminants or pathogens, the water loss may be defined as Category 3. An example would be a water damaged home where there is severe pet urine and feces contamination.

2.4.5 ATP Sampling Procedures

ATP sampling helps to determine how much contamination is on a surface. This can be very helpful information either at the beginning of a loss to determine if decontamination will be necessary, or after decontamination procedures have been completed to evaluate the effectiveness of remediation efforts.

For sampling to be effective you must be very careful to follow the correct process. For example, sampling too large an area will produce inaccurate high numbers, and sampling an area too small will give low results. Also, sampling a surface that is very soiled will produce inaccurate results.

Sampling Process

Below is a simple, but effective process for ATP sampling:

1. Area to be sampled must be clean of debris. If the area is soiled, the test results will be inaccurate.

2. Sample a 2”x2” area. The goal is to ‘clean’ the area.

3. Roll the swab as you are sampling to get coverage on all sides of the swab.

4. Test the swab following the ATP meter’s instructions.

5. Analyze results against currently available threshold values which are found below.

6. In event of a ‘fail’ or ‘caution’ result repeat decontamination processes and retest until a ‘pass’ result is achieved.

The following table[1] can be used to determine the contamination levels of surfaces in a structure. A pass result is needed for a surface to be considered acceptable.

2.5.1 Managing Water In The Vapor Phase

Water is primarily found in two phases in the water damage environment: liquid and vapor. To remove liquid from a wet structure it is first extracted and what is left must be evaporated, or changed to vapor. Therefore drying includes understanding and managing water when it is the vapor phase.

Vapor In The Air

Vapor in the air is reduced by dehumidification or ventilation. It requires removal of some of the moisture that is in the air. Change in the moisture content of air can occur very rapidly since no phase change (evaporation or condensation) must take place.

Vapor in the air simply moves from high to low. If high humidity ratio (measured as GPP, dew point or vapor pressure) exists in a structure and a dehumidifier is lowering the humidity ratio, high moves to low. Evaporation on the other hand is a phase change that requires the addition of energy and increases time.

Vapor In Materials

Water also exists in the vapor phase in materials. Vapor can be sensed as moisture content with a moisture meter. It can also be measured as relative humidity using a hygrometer and material specific testing procedures. This is termed an ERH reading and is most commonly utilized in our industry when taking moisture readings of concrete.

Vapor moves in and out of materials based on the same forces that move vapor around in the air. High goes to low. When you want to move moisture out of materials, put dry air around those materials. How dry?

Equilibrium Moisture Content

Look at an Equilibrium Moisture Content (EMC) table to see the relationship between the vapor in the air and the vapor content of materials. Using the temperature and relative humidity of the air around a material, an EMC table will tell us what moisture content that material will acclimate to.

Examining the EMC table shows that the primary driver is the relative humidity of the air. As it increases, the moisture content of the materials increases. This is because relative humidity is a measure of the percentage of vapor saturation in the air. There will be a corresponding vapor saturation of the material.

When water damage occurs in a building the relative humidity of the air increases. When that happens the vapor content of the materials starts to increase. We see the effects in the form of sticking doors and high moisture content in drywall that liquid never touched. The excess vapor in these materials can be removed relatively quickly since it does not need to go through a phase change.

Managing Water Vapor

To achieve drying goals you must create drying environments that can remove excess vapor from materials as well as evaporate excess liquid. You can reduce the EMC by heating air and/or reducing humidity ratio to remove excess vapor. Note that removal of *vapor* is different than *evaporation* which requires heating materials, not the air.

Fortunately good evaporative conditions will remove excess vapor. Reaching Evaporation Potential goals will speed the removal of vapor.

Ensure that the air conditions in a drying environment will allow EMC that is lower than the target moisture content of the materials you are drying. This can be found on an EMC table.

Use caution though not to target extremely low EMC conditions by superheating or over drying the air in an effort to speed drying. These conditions are often created by using large heaters that do not allow you to direct the heat (they only allow ducting of air). Oversized or improperly monitored desiccant dehumidification can over dry the air creating the potential for problems as well. The problem is that while these conditions will remove excess vapor from wet materials, the air is also exposed to materials that were never wet. When this happens 'dry' materials release vapor and over dry as they seek equilibrium with the air around them. This leads to cracking and warping of trim, cabinets and other moisture sensitive materials.

This problem can be prevented by not exposing dry materials to air that will produce an EMC that is more than a few percentage points lower than their normally acclimated moisture content. This is especially important when drying will take more than a couple days.

2.6.1 - The Phases Of Water

There are three phases of water found on the earth: solid, liquid and gas. Primarily the phases that we find on water restoration jobs are liquid and gas. Our ability to dry buildings is dependent on our ability to manage water in these phases.

Managing Water In Different Phases

When we first arrive at a job site we typically find a large amount of water in the liquid phase so we extract. Removal of water through extraction is the most efficient method of water removal. It is important to thoroughly extract as much water as we possibly can. What is left must be removed by a phase change.

A change from liquid to gas, or gas to liquid is called a phase change. The phase change from liquid to gas is called evaporation. The phase change from gas to liquid is called condensation.

In order for us to remove water from a wet material we must evaporate water from the surface into the air for removal. Water in the drying environment is continuously changing from liquid to gas and back to liquid. It is our job to create more evaporation, or water leaving the surfaces as a vapor, than condensation. This lowers the moisture content of the surfaces in the building. While that water is in the vapor phase we then remove it from the building through the dehumidification or ventilation to the outside of the building. How do you control the phase water is in?

Creating A Phase Change

To create a phase change we must have energy. Energy is movement within the molecules. The less energy the water molecules they have, the less able they are to pull away from other water molecules and the more energy they have the more likely they are to pull away in the vapor phase. This is because the molecules want to stick together like magnets because of hydrogen bonds.

When molecules have very little energy they may lock together in a hexagonal honeycomb-like shape we call ice. These molecules have so little energy that they form many hydrogen bonds and lock together.

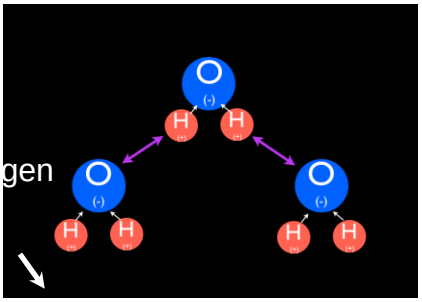
As you add energy molecules are able to break some of those hydrogen bonds. As they break those bonds the honeycomb shape that they have locked into is broken down, but the molecules cannot completely free themselves from one another. We called this phase liquid.

If even more energy is added eventually molecules are able to break all hydrogen bonds. When this happens the molecules are free to float individually, single molecules. We call this phase vapor. While these molecules that are in the vapor phase have the most energy it is not necessary to boil water in order for water molecules to enter the vapor phase. Boiling is not a phase change. There is vapor in the air at all temperatures found on earth. With that said the more energy available the more water that can be found in the vapor phase.

It is the level of energy that water molecules have that determine the phase that they are in. This means that in order for us to control the phase of water we must manage energy. Much of the drying process is about managing energy.

2.6.2 Hydrogen Bonding and Cohesion

The positive charge of hydrogen and the negative charge of oxygen creates a bond similar to a magnet called *hydrogen bond*. It is neither a Van der Waals interaction nor a covalent bond.



It is this bond and the number of hydrogen bonds that a water molecule is capable of making that gives water several unique properties. Interesting to us because one of those properties is the ability of water to move through materials. Hydrogen bonding is responsible for many of the unusual characteristics of water, namely its relatively high boiling point (and low vapor pressure) for a molecule of its size, the wide range of temperature that this small molecule exists in liquid form, its lower density in the solid form compared with its liquid form, and its propensity to form dome-like droplets on surfaces.

Cohesion

Water wants to stick to itself due to the hydrogen bonds that it forms. This desire to stick to itself is called cohesion. Cohesion is an important quality that makes water movement in materials possible. As water molecules leave the surface of a wet material during drying, cohesion of the molecules to each other allows more water to be pulled to the surface. This process continues through the drying cycle.

There is unnecessary concern expressed by some that high speed drying in water restoration could break the cohesion between the molecules and create case hardening during wood drying. This is an unnecessary concern. Case hardening is possible when drying wood that is saturated through such as green wood that is being kiln dried. While case hardening does occur when green wood is dried too fast, the combination of cohesion and the solid wood materials that we are drying only being wet at the edge, case hardening is not a concern in high speed water restoration drying.

Hydrogen bonding is affected by temperature and pressure. When water is frozen it can form up to 4 hydrogen bonds, a large number for a simple molecule. As water is heated, the number of hydrogen bonds is reduced due to the additional energy or movement contained in the water molecules. In order for water to move into the vapor phase it must break all the hydrogen bonds it has made. This is why water is liquid at such a wide range of temperature and it requires so much energy to create water vapor.

This understanding of hydrogen bonding and cohesion helps the drying professional to understand that energy is required for evaporation to occur. Add energy to the water molecules to help speed the phase change from liquid to vapor. Additionally cohesion between the molecules keeps them from pulling apart as moisture is drawn to the surface so that it can be evaporated. As this process continues moisture content is reduced and the material is dried.

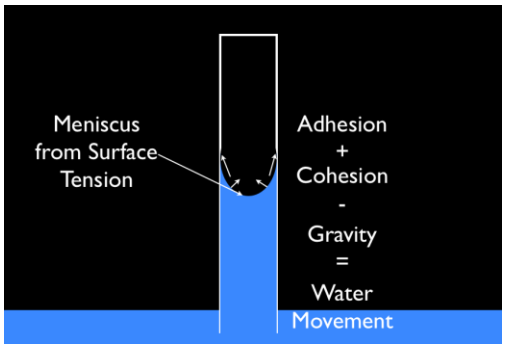
2.6.3 - Adhesion, Cohesion and Capillary Action

Adhesion and cohesion are a result of hydrogen bonds. Hydrogen can bond with polar substances. These attractions are due to opposing charges, like a magnet. Water will stick to itself through these bonds and it is called cohesion, sticking to itself. When hydrogen bonds are made to other polar substances this is called adhesion.

The effects that adhesion and cohesion have create some interesting results. Have you ever noticed that you can pour water to the point that it is actually over the rim of a glass yet it does not pour over the edge? Or if you touch water with something wood or metal the water 'sticks' to it? Try the same thing with a plastic straw and you will find that there is no adhesion because the plastic does not offer an opposing pole to create the hydrogen bond and adhesion. What you are observing are the effects of adhesion and cohesion at work. These effects are also at work in the wet materials that we are drying.

Capillary Action

Capillary action is water movement due to adhesion and cohesion. When adhesion is greater than cohesion capillary action occurs. Let me explain how this happens. Water sticks to itself, cohesion. Adhesion is water sticking to other polar materials, such as wood or metal. When the adhesive attraction is greater than the cohesive attraction then water will move along the material to continue creating more adhesive hydrogen bonds. It doesn't break the cohesive bonds so it pulls more water molecules along. This causes water to react in unexpected ways. Look at the picture on the left.



The picture illustrates how a narrow glass tube when placed in water will draw water up inside the tube to height greater than the level of the water it was placed in. This occurs because adhesive hydrogen bonds draw water up the edge of the tube since glass is polar. Cohesive attraction between water molecules prevents the adhesive draw from pulling them apart. These two forces cause the water to be drawn upward due to capillary action.

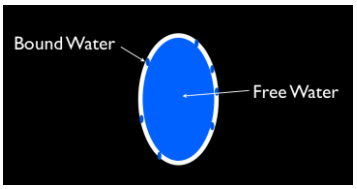
Capillary action is how water moves through materials. Adhesive forces move water through the material and cohesion holds the molecules together to draw all the moisture out.

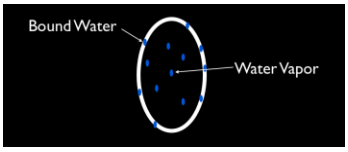
This helps us to see one reason why certain materials dry differently that others. Since wood cells have many pits and openings to allow water to move through them, water moves quite easily through wood materials through capillary action. Just dry at the surface and the internal moisture will come out. Other materials like concrete do not allow capillary action to occur as easily because of a lack of openings from air pocket to air pocket. This dramatically increases the amount of time that it takes for moisture to be released from these materials.

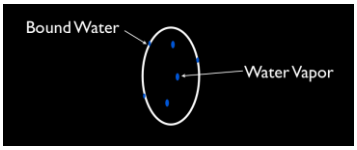
2.6.4 - Free Water, Bound Water and Water Vapor in Wood

Water exists in wood and wood products in three different ways: free water, bound water and water vapor. How water is contained in wood will determine how it is removed from that wood.

Free water is water that is in the liquid phase and is contained in the voids or lumens in the cells. It is not water that is absorbed into the cell walls and it does not change the dimension of the cell. This water must go through a phase change at the surface of the material and convert to water vapor to leave the surface. Free water can be removed fairly rapidly. If there is any free water in the wood cell the material is above the fiber saturation point of the wood.







Bound water is water in the liquid phase and is absorbed into the walls of the cells. Bound water is removed much more slowly than free water and does not leave the cell till all free water is removed. At the point at which all free water is gone but no bound water has yet been removed, the material is at the fiber saturation point. This is the point at which the cells can no longer absorb water into the cell walls because they are saturated. Bound water leaves the cells by either evaporating into the lumens or voids in the cells and equalizing with the environment around the material or by capillary action moving moisture from cell to cell to the surface of the material to be removed by evaporation.

Water vapor exists in the lumens or voids of the cells when they are not filled with free water. This water vapor equalizes throughout the material as well as with the moisture content of the air. An Equilibrium Relative Humidity (ERH) chart shows the amount of moisture as water vapor that will exist in wood when it is normally acclimated based on the temperature and relative humidity of the air around it. During drying water vapor can build up in the lumens of the cells as bound water evaporates some vapor into these voids. At this point the vapor content of the material will be much higher than the ERH of the air.

The drying technician will want to focus on Evaporation Potential throughout the drying process when dealing with wet wood. EP tells the technician whether the wet wood is warm enough and the air is dry enough to create sufficient evaporation from the surface. Though bound water is removed slower than free water the drying process does not need significant change.

3.1.1 Removing Drywall and Trim

It is often necessary to remove water damaged materials from the structure. This may also be to facilitate drying, trying to get the hot, dry, airflow to the water. Perhaps removal is necessary due to mold or other microbial contamination.

Clean and Professional

While we often call this demo we need to make sure that our removal of materials is both clean and professional.

There are 3 things that we need to consider when we are removing materials:

1. Cleanliness including sweeping up and dust control.

2. Appearance including cutting straight lines.

3. Ease of replacement which includes removal of nails and cutting at the proper height.

Removing Trim

1. Score the caulking between the trim and the wall.

2. Use thin flat bar like a 5 in 1 to get the base loose.

3. Use a flat pry bar to remove the base the rest of the way, prying against the baseplate NOT the drywall.

4. If there is a lot of trim to be reinstalled mark its location for easy reinstall. This can be done by numbering the trim and putting the same number on the drywall where the trim goes.

5. Remove nails.

Cutting Drywall

1. Determine the height at which to cut the drywall. That may be either below the level of the base or at one, two or 4 feet depending on the height of the water. Also add half an inch to each measurement to allow the drywall to be raised half an inch off the floor.

2. Measure and mark the drywall at the height you would like to cut.

3. Chalk a line at this height.

4. Using a drywall saw cut exactly on the chalk line. Do not allow the cut to waver back and forth across the line.

5. Carefully remove the drywall and nails or screws.

6. Sweep or vacuum dust and debris.

3.2.1 - Crawlspace Basics

Crawlspaces present unique challenges, in both logistics and drying. Crawlspaces can be low, have no power or lights, they are dirty and sometimes moldy. They are also hard to dry because of these and other factors. For these reasons many technicians avoid crawlspaces or dread dealing with them.

Vents and Entrance

Vents

Should they be open or closed? It depends on the drying strategy. The vents do allow you the ability to draw air into the crawl in a balanced fashion. If this is part of the drying strategy, which we will discuss later, open them. If not, like when you are using dehumidification to remove moisture, close them.

Entrances

The type of entrance available is highly variable depending on what region of the country you live in. If there is a door to the outside in addition to it being how you get in and out of the craw., it will likely be used as an exit point for air. Often you will be ventilating out of the crawl through this opening.

In the case that there is no access or extremely limited access to the crawl from the out side, you will have to open an entry point on the inside of the building. This will likely mean cutting an opening through the floor in a closet or another room. This opening should be protected against fall hazard and you also want to make sure that air is not being drawn up through this new opening into the building. Stack effect, or the natural rise of air through a building, will cause air to move up from the crawlspace into the building unless you use negative pressure in the crawl to pull it back down.

Crawlspace Interior Components

Soil

Soil is highly porous. It will accept and release water very quickly. The concern here is that too much Evaporation Potential and air flow will create a rate of evaporation that is greater than your ability to remove humidity from the crawl. That forces moisture into the structural materials or at best brings drying to a halt.

Moisture Barrier

A poly sheeting, depending on region, is often installed over soil. This is done to trap moisture in the soil and keep it out of the house. Usually these are improperly installed or in disrepair and therefore release a lot of moisture from the soil. If this is the case it may need to be repaired or replaced to facilitate drying.

Structural Materials and Concrete

These materials have bound water or water that is more difficult to remove. They require higher

3.2.2 Drying Crawlspace Structure

Drying crawlspaces is generally considered to be a challenge. This is because we have three pieces to manage and they fight against one another.

1. Evaporation
2. Dehumidification
3. Ventilate for Pressurization

Here's a some examples of the challenge:

- Too much ventilation and dehumidifiers can't keep up and rate of evaporation drops.
- Too much evaporation and dehumidification can't keep up.
- Too little ventilation and potentially hazardous stuff gets into the structure.
- Too little dehumidification and humidity builds up.
- Too little evaporation and the job takes too long.

Balance

We must balance the rate of evaporation with necessary dehumidification and ventilation for pressurization.

An ever present issue is that we just can't get moisture out fast enough because the soil releases moisture so fast. Too much evaporation and humidity just redeposits moisture in materials or condenses and in addition drying up above slows down.

The best approach to drying a crawlspace may be to break up the drying of the structure and soil if the loss is sizable. This is because we have soil releasing a lot of water very quickly, and structure releasing very little water slowly. If the Evaporation Potential is too high and soil releases water too quickly and if the Evaporation Potential is too low the structure will dry slowly.

Not required that we break them up. Some jobs are small enough to be kept together because the rate of evaporation not a problem. We are going to assume that you are going to break up this job.

Prioritize and Contain

Our first priority is to get the living space dry and second to get the soil dry. So first put plastic around the wet area. Cut the plastic 2 feet too long and let it drape to the ground. Cover the soil with plastic if there isn't one already in place. Some moisture is just going to soak into the ground during the drying of the structure.

Remove insulation that is present at the wet structure. If there is wet structure you have to drop the insulation to get hot, dry airflow to it. You may be able to dry the insulation if there is an area that you can place it for drying, otherwise replace.

This leaves us with only the wet structure exposed. That is a drying environment that is slow to release moisture and needs sufficient EP to dry. Dehumidification is important, but not that difficult. Now we know what kind of drying environment we want to set up.

Negative Ventilation for Containment

Start with one air mover pulling air out of the crawlspace. Then check the vents to make sure that you have air returning to the crawlspace from the vents. Check with a small piece of plastic to make sure air is being drawn in. This is being done purely to contain any contaminates in the crawlspace from the structure upstairs.

Moisture Removal

Since this is an environment that is releasing moisture fairly slowly start with the Class 2/Class 4 divisor.

IF you are using dehus and IF the dehu can be placed into the crawl, do it, otherwise it will need to be ducted in and out.

If you are adding heat you need to determine whether you are going to need to ventilate that heat and humidity or dehumidify. If you are concerned that heat is going to build up too high, then add additional ventilation that is thermostatically controlled and open the vents. If it is cold outside and you need to conserve heat then it would be better to leave the vents closed and dehumidify instead of adding additional ventilation.

Evaporation

Establish evaporation with air movement and heat. You cannot control the temperature outside, but it is important that you control the temperature inside the crawl. This will often involve the addition of heat.

Use EP to decide. You need a minimum of 1.5 EP and preferably 3.5 EP with the addition of heat. Air movement should be directed at the wet structure and not in a vortex around the crawl.

3.2.3 Drying Crawlspace Soil

If you have chosen to break up the drying of the crawlspace, drying the soil is going to be done **after** the drying of the structure. If you haven't reviewed 3.2.2 Drying Crawlspace Structure yet, you should reference that system first.

Balance

We must balance the rate of evaporation with necessary dehumidification and ventilation for pressurization.

When drying soil evaporation occurs very quickly and we potentially have issues getting vapor out of the crawl fast enough. If your drying system gets out of balance, too much evaporation and not enough humidity removal, moisture will redeposit in materials or condense on cool surfaces. Additionally the humidity will likely move up into the structure and drying up above in the living space slows down.

Contain

First put plastic around the wet area. Cut the plastic 2 feet too long and let it drape to the ground. Uncover the only the saturated soil if plastic is already in place.

Extract any standing water through pumping and extraction.

This leaves us with only the wet soil exposed. That is a drying environment that releases moisture quickly. We may actually need to keep EP low initially to keep humidity control in balance. Dehumidification will be difficult with the release of lots of moisture quickly.

Ventilate to Contain Contaminates

Start with one air mover pushing air out of the crawlspace. This will create a slight negative pressure as well as exchange the air in the crawl with outside air. Check the vents to make sure that you have air returning to the crawlspace from outside. This is being done purely to contain any contaminates in the crawlspace from the structure upstairs.

Dehumidify

Since this is an environment that is releasing moisture quickly start with the Class 3 divisor even though Class 4 is normally specified for crawlspaces. We are drying soil which releases water rapidly. I would not recommend using a desiccant unless you are using a very large desiccant that has sufficient heat to remove moisture from the desiccant wheel.

IF you are using dehus and IF the dehu can be placed into the crawl, do it, otherwise it will need to be ducted in and out.

If you are adding heat you need to determine whether you are going to need to ventilate that heat and humidity or dehumidify. Here is how you will determine your answer: If heat buildup is a concern, then add additional ventilation that is thermostatically controlled and open the vents. If it is cold outside and you need to conserve heat then it would be better to leave the vents closed and dehumidify instead of adding additional ventilation.

Evaporation

Establish evaporation with air movement and heat. You cannot control the temperature outside, but it is important that you control the temperature inside the crawl. This will often involve the addition of heat.

Use EP to decide. Normally in drying we try to raise the EP as high as is reasonable to speed evaporation. In this case it might be necessary to keep the EP low so that the rate of evaporation does not exceed dehumidification. If during monitoring you are having a hard time controlling humidity, lower EP by cooling the environment or adding dehumidification if possible. You should maintain between 1.5 EP and 3.5 EP with the addition of heat.

Air movement directed at the soil in a vortex around the crawl may work, but remember you aren't usually trying to dry walls which is one of the primary reasons for setting the air movers up in a vortex. Make sure that air movement is directed at the wet soil.

If drying is too slow increase EP by adding heat or preserving more of the heat that you are introducing. If humidity is too high, reduce EP, increase dehumidification and or ventilation.

3.2.4 Drying Low Height and Limited Access Crawlspaces

A common situation found when drying crawlspaces is a crawlspace that is either too low to get equipment into or perhaps has no entrances at all. This makes it very difficult to work in. It may make it impossible to even get into. These spaces still have to be dried though.

If you can't get into the crawlspace then you have two options:

1. Build containment outside of the crawlspace, put equipment in that and duct into the crawlspace.
2. Cut a section of the floor out in a carpeted area inside the home and duct air in through that opening.

Building a Containment

While there are many ways to build containment the easiest way is to use materials common to a restoration contractor. We often build containment for mold remediation out of polyethylene sheeting and PVC pipe. That same type of containment can be built outside along with the equipment used to dry crawlspaces. The containment that you build must be large enough to house the dehumidification or heating equipment that you will be ducting into the crawlspace. Do not place any combustion heating equipment inside the containment.

First erect a frame out of PVC and connectors. 1 inch PVC makes for a sturdy containment. Once the frame is built, wrap that frame with polyethylene sheeting attaching it either with zip ties or tape and adhesive. The problem with tape and adhesive is that it does not hold up very well outdoors.

Place the drying equipment that you're going to use to blow hot dry air into the crawlspace, inside the containment. Duct the air coming out of the dehumidifier or the heater to the farthest point in the crawlspace. By doing this you will force the air in the crawlspace to come back to the containment and recirculate through your machines. Additionally you must draw air out of the crawlspace to negatively pressurize that area so that you don't force humidity and contaminants into the living space above.

Through The Floor: If there is no access to the crawlspace from the outside then your only option is to enter from the living area of the building. The best way to do this is to go to a carpeted area, a closet if possible. By pulling back the carpet and exposing the subflooring you can make an opening into the crawlspace. Cutting a hole in the subfloor will not create a costly repair. The opening needs to be large enough to duct airflow through.

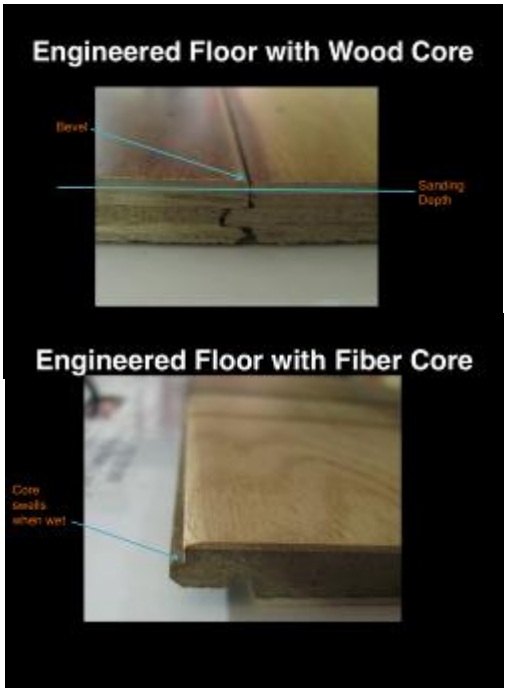
It would be best to make one opening in the floor on one end of the crawlspace and another opening in the floor on the other end if possible. This will allow you to push air in through one opening and draw air out through the other opening pushing that air outside of the home. This will create circulation through the crawlspace drawing out moist air. Be sure that you pull out more air then you push in. This process will be slow but is your only option when drying a crawlspace that has no outside access.

3.2.5 Crawlspace Drying Process

1. Inspect for moisture. Are there wet areas in the living area of the structure?
    a. Yes- Set up drying in the living space as well. Step 2.
    b. No- Go to Step 2.
2. Extract any standing water and remove insulation from all wet areas.
3. Is the entire crawlspace wet?
    a. Yes- Go to step 4.
    b. No- Drape plastic around the wet area from the floor joists down on to the ground. Go to step 4.
4. Install ventilation to contain contaminates. Test to make sure air is moving toward crawlspace.
5. Are you splitting the drying of the soil and the structure into two separate processes?
    a. Yes- Go to Step 6.
    b. No- Skip to Step 8.
6. Lay plastic over the soil if there isn't any there already.
7. Choose drying process:
    a. Conventional - Set air movers aimed toward structural materials. Use Class 4 divisor to determine initial dehumidification needs. Close foundation vents. EP should be between 1.5 and 2.5.
    b. Directed Heat Drying - Use one ETES or TEX box and 1-2 air movers per 300-500 square feet. Add another ventilation air mover. Open foundation vents. EP should be 3.5 or better.
8. When structure is dry or if drying both soil and structure together, remove any plastic that is laying over saturated soil.
9. Choose drying process:
    a. Conventional - Set air movers in vortex. Use Class 3 divisor to determine initial dehumidification needs. Close foundation vents. EP should be between 1.5 and 2.
    b. Directed Heat Drying - Use one ETES or TEX box and 1-2 air movers per 500-750 square feet. Add another ventilation air mover. Open foundation vents. EP should be 3.5, but should be reduced if humidity gets too high.

3.3.1 Hardwood Technical

What floors should be restored?



When discussing hardwood drying this is typically referring to solid hardwood over wood subfloor. These floors may be restored as long as they have not buckled off the floor pulling the nails out.

Engineered wood floors likely are either irreparably damaged or cannot be refinished with a high degree of success. This doesn't mean that engineered floors cannot be dried or should not be dried but the results need to be discussed with the property owner. They need to be aware of what to expect.

Floors installed over concrete are either impossible to dry due to the installation method that was used or they will be engineered flooring that has potential problems with the finished product.

Floors that are more than 3 inches wide and are severely cupped will also present problems. Because of the extra width of the board, cupping will cause the edges to pull up higher. This causes nails to either pull through the wood or pull out of the sub flooring leaving a squeaky floor. This doesn't mean that you cannot restore wide plank floors but that the property owner must be informed that the floors will likely squeak. Some property owners will prefer this to replacing the entire floor. Give the option to the property owner.

2. **Why do floors cup when they get wet?**

Hardwood floors cup because the bottom of the board expands as it gets wet. The top of the board remains the same size because the polyurethane coating acts as a moisture barrier preventing moisture intrusion into the cells at the top of the board. Because the bottom of the board expands and the top of the board does not, this causes cupping.

The amount of cupping to expect can be determined by examining the dimensional change coefficient. Each species of wood has a different coefficient. For example Red Oak has a dimensional change coefficient of .00369. By inserting this coefficient into the dimensional change formula we can determine how much change there will be in the width of the board.

Dimensional Change Formula

(Moisture Content Change X Dimensional Change Coefficient) X Board Width (inches) = Inches of change per board.

3. **Will the floors lay back down when they dry?**

The answer is yes.

Whether the floor is increasing or decreasing in moisture content the dimensional change coefficient applies. This means that a floor that increased in size because it picked up moisture content will decrease the same amount as it loses that additional moisture content. The result will be that the floor will lay back down.

Many restorers observe that floors remain cupped after they complete the drying process. The most likely cause of this is improper moisture reading techniques. The wood is still wet even though the technician believes the floor is dry due to the moisture readings he has taken. See how to take moisture readings below.

Another cause for this is when floors are wet too long before drying begins. Also if drying takes too long floors can retain 'memory' of the cupping that they exhibited. Both of these examples can be eliminated by quick response and proper drying techniques.

4. **Will floors that have been dried need to be refinished?**

Most floors that have been dried will need to be refinished. There are too many variables during the drying process to be able to guarantee that the appearance will be correct without refinishing. Also property owners vary in expectation level and this also cannot be controlled.

Refinishing should be considered a standard part of the restoration process. That doesn't mean that all floors must be refinished after they are dried, but the appearance of the floor finish does not define success in the drying process.

5. **How do I take moisture readings?**

One of the most common errors in hardwood drying is using a non penetrating meter to take final moisture readings on hardwood flooring. Noninvasive or non penetrating meters only read three quarters of an inch deep. A typical installation for solid wood flooring is a total of 1 1/2 inches thick including the subfloor. This means that noninvasive meters cannot read the entire installation of the wood. This gives you false dry readings too early.

Proper readings of moisture content in hardwood floors should be taken using a hammer probe with insulated pens and these readings should be taken from below. No hammer probe readings should be taken through the top of the floor as this permanently damages the appearance of the floor.

Readings should be taken at multiple depths so that it can be ascertained where the moisture is in an installation. For example the bottom of the subfloor maybe dry but the top of the subfloor and the bottom of the hardwood may still have high moisture content. Having this information helps us to know where we should focus our drying process.

3.3.2 Hardwood Floor Drying Process

(Note: This process flow is designed as a guideline. Thorough inspection is required. There are many complexities that are not covered in this process flow.)

1. Inspect for moisture. Create a drying chamber in the area below the hardwood.

2. Apply antimicrobial to the affected floors and walls.

3. After extracting hardwood floors for 10 minutes is there water under the panels?

   a. Yes- Continue extracting and wiping up water until little or no water is found under the panels. Go to Step 4.

   b. No- Go to Step 4.

4. If walls are wet, do they have a non permeable wall covering? (wallpaper, several coats of paint, semi-gloss paint, lead based paint, etc.)

   a. Yes- Remove baseboards, cut a 2" strip off the bottom of the drywall to allow drying from the back of the drywall.

   b. No-Go to Step 5.

5. Tape down panels over the wet floors and attach to the vacuum system.

6. Choose drying process:

   a. Conventional - Use Class 4 divisor to determine initial dehumidification needs. EP should be between 1.5 and 2.5. You may need to add air movers to create some air movement around the perimeter if using a small dehumidifier with low air flow.

   b. Directed Heat Drying - Use one ETES or TEX box per room up to 200 square feet. EP should be 7 or better. Set up thermostatically controlled ventilation or dehumidification to control humidity.

7. After installing plastic containment, sandbags and drying equipment, is plastic floating through the entire wet area?

   a. Yes- Go to Step 8.

b. No- Make sure to remove large wrinkles from plastic. If plastic still won't float, turn up air mover in ETES or if using dehumidifier limit air escape from edges of plastic by adding sand bags.

8. Do a final check of all connections to be sure that no hoses were knocked loose during installation of the other equipment and containment.

3.3.3 Moisture Readings For Hardwood Floors

Moisture readings on hardwood floors are very important because the moisture content of the floor affects its appearance. A floor that is higher than normal in moisture content will remain cupped. Additionally it is important not to damage the appearance of the floor while taking moisture readings.

Improper Moisture Reading Techniques

There are two common mistakes made when taking moisture readings on hardwood floors:

1. Using a non penetrating meter to determine if a flooring installation is completely dry. This meter only reads about 3/4" of depth and cannot read the entire depth of the wood and subfloor installation nor will it indicate at what depth moisture is found.

2. Using a hammer probe from the top of the floor. This creates damage that cannot be repaired completely. This should be avoided unless no other option is possible.

Use An Invasive Moisture Meter

Moisture readings that are delivered as a percentage are going to be necessary. Dry readings need to be within 2-4 percentage points of the unaffected areas of the floor. The only type of meter that is going to give this type of reading is an invasive meter, a meter with pins. These meters allow you to go to where the moisture is instead of getting an approximation of the entire depth of the installation. If the surface temperature of the floor rises substantially above 70F it will be necessary to adjust the moisture readings for the temperature of the material.

Where To Take Moisture Readings

Floors must be dried from above and below. This means that access to the floor must be gained from below. Therefore you will not be cutting out drywall just to take readings on a floor. It should already be done.

Using a hammer probe from the bottom of the floor allows you to get readings without creating damage to the finished surface of the floor. The pins are only usually around 1-1/8" to 1-1/4" in length. The total floor surface is typically 1-1/2" so the pins will not go all the way through most solid wood floors. By taking readings from below you can get the readings that are necessary without damaging the floor.

Both the subfloor and the hardwood must be dry in order to complete the project. Record readings of both hardwood and subfloor on your moisture reading form. Take readings in a number of locations and record enough readings to give a good picture of what is happening in the floor.

Look at the top of the floor and if you see areas that are cupped, take readings from below in these areas. Understand that cupping indicates moisture at the interface between the subfloor and the wood and not necessarily deep in the hardwood. Expect to find moisture at about 3/4" of depth with your pins. Dry until cupping is gone and your readings agree that the floor has returned to a moisture content similar to unaffected areas.

3.4.1 In-Place Drying Process

(This process flow addresses commonly found issues but a thorough inspection is required. Use professional judgment to adjust process to each individual situation.)

1. Have you done a full inspection of the perimeter to identify all wet areas? (ie. Basement, crawlspace, etc.)
    a. Yes- Establish drying in those areas.
    b. No- Extract and go to step 2.

2. After extraction test, can you squeeze any water out of the pad?
    a. Yes- Repeat extraction until no water can be squeezed out or remove pad.
    2. No- Go to step 3.
    c. Not sure- Repeat extraction until sure or remove pad.

3. Block and tab furniture.

4. If walls are wet, do they have a wall covering with low permeability or moisture barrier? (wallpaper, several coats of paint, semi gloss paint, etc.)
    a.Yes- Remove baseboards cut two inch strip off the bottom of the drywall unless lead based paint. You may also choose to drill holes but they do not allow as much air flow and walls will dry slower.
    b. No- Go to step 5.
5. Apply botanical antimicrobial to wet floors and wall surfaces.

6. Install dehumidifiers per initial guidelines.

7. Install air movers every 10-16 linear feet, add more as necessary for closets and other offsets, at the appropriate angle making sure that there is airflow on all wet surfaces.

8. During monitoring visits check to make sure that EP is 1.5 or greater and that moisture readings are progressing satisfactorily.

3.4.2 Directed Heat Drying Process for Carpeted Areas

(This process flow addresses commonly found issues but a thorough inspection is required. Use professional judgment to adjust process to each individual situation.)

1. Have you done a full inspection of the perimeter to identify all wet areas? (ie. Basement, crawlspace, etc.)

    a. Yes- Establish drying in those areas.
    b. No- Extract and go to step 2.

2. After extraction test, can you squeeze any water out of the pad?

    a. Yes- Repeat extraction until no water can be squeezed out or remove pad.
    b. No- Go to step 3.
    c. Not sure- Repeat extraction until sure or remove pad.

3. Block and tab furniture.

4. If walls are wet, do they have a wall covering with low permeability or moisture barrier? (wallpaper, several coats of paint, semi gloss paint, etc.)

    a. Yes- Remove baseboards cut two inch strip off the bottom of the drywall unless lead based paint. You may also choose to drill holes but they do not allow as much air flow and will dry slower.
    b. No- Go to step 5.

5. Apply botanical antimicrobial to wet floors and wall surfaces.

6. Will HVAC and ETES controls maintain desired temperatures adequately?

    a. Yes- Use one dehumidifier for each ETES unit initially and reduce as necessary after 24 hours.
    b. No- Use one ventilation fan per 1 (summer) -2 (winter) boxes. Be sure that exhaust device is at the farthest point from air return and that you have at sufficient makeup air.

7. After installing TES and turning the air mover to high speed, is carpet floating through the entire wet area?

    a. Yes- Go to step 8.
    b. No- Make sure carpet is pulled tight and attached at the tack strip. If carpet still won't float add another air mover under carpet next to the TEX box.

8. Is air coming out of the vents that you have opened in each corner?

a. Yes- Float and setup is correct
b. No- Is carpet floating at vent?

i. Yes- Open vent a little more or place a furniture block under the carpet.

ii. No- Go back to step 7.

9. During monitoring visit, is drying progressing satisfactorily?
    a. Yes- Continue until dry.
    b. No- Step 10

10. Is EP 7 or above?

3.4.3 - Conventional Drying Process When Removing Padding and Drying Carpet

(This process flow addresses commonly found issues but a thorough inspection is required. Use professional judgment to adjust process to each individual situation.)

1. Have you done a full inspection of the perimeter to identify all wet areas? (ie. Basement, crawlspace, etc.)

    a. Yes- Establish drying in those areas.
    b. No- Extract and go to step 2.

2. Move furniture to one half of the room and carefully lay back the other half of the carpet. Remove the padding in that area and place in a wheeled barrel or bag. Repeat for the other half of the room.

3. Block and tab furniture.

4. If walls are wet, do they have a wall covering with low permeability or moisture barrier? (wallpaper, several coats of paint, semi gloss paint, etc.)

    a. Yes- Remove baseboards cut two inch strip off the bottom of the drywall unless lead based paint. You may also choose to drill holes but they do not allow as much air flow and will dry slower.
    b. No- Go to step 5.

5. Apply botanical antimicrobial to wet floors and wall surfaces.

6. Install dehumidifiers per initial guidelines.

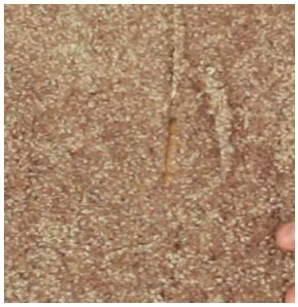
    a. Class 1 - cubic footage/100 = pints of dehumidification
    b. Class 2 & 4 - cubic footage/50 = pints of dehumidification

    c. Class 3 - cubic footage/40 = pints of dehumidification

7. Install air movers every 10-16 linear feet at the appropriate angle making sure that there is airflow on all wet surfaces.

8. During monitoring visits check to make sure that EP is 1.5 or greater and that moisture readings are progressing satisfactorily.

3.4.4 Cutting Seams In Carpet



Very often when working in the water damage environment you will find that it is necessary to cut open a seam in carpeting. This is most likely because you need to remove padding and save the carpeting. If the seam is cut improperly the carpet can be permanently damaged. This is costly and embarrassing. With a few simple tips and some practice, seams can be cut properly each time.

Use a sharp blade. The blade must be extremely sharp so that it slices the carpeting and doesn't shred or tear the materials. When carpet is wet it is very susceptible to damage as it is weak. A sharp blade can avoid unnecessary damage. Replace the blade for *each* seam cut. Preferably a carpet blade should be used instead of a utility blade since it is designed with a sharper edge.

Cut a new seam instead of cutting through the old one. This may seem backwards, but cutting the old seam holds the greatest potential for ruining a seam. If you are skilled and patient enough to cut exactly on the seam that will work, but due to the difficulty even an expert carpet repair technician will often just cut a new seam to avoid damaging an existing seam.

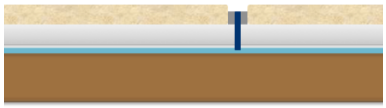
Open up a row of fibers to prevent cutting fibers. When fibers are cut they are lost from the face. This makes the seam more visible and is impossible to repair. Use either an awl or row cutter to open a row of fibers to expose the backing and prevent cutting face fiber.

Cutting A New Seam

Move at least 3" away from the existing seam to start a new seam.
Open a row of fibers using an awl or row cutter to prevent cutting face fibers.
Slowly cut the seam using a row cutter or a knife with a new carpet blade.

3.5.1 - Ceramic Tile Drying Process

Drying ceramic and stone over a wood subfloor has some unique challenges. The issue is getting the hot, dry air flow to the water. Water gets trapped between the tile and the subfloor in the concrete board. Since that is where the water is, we need to get air flow there.

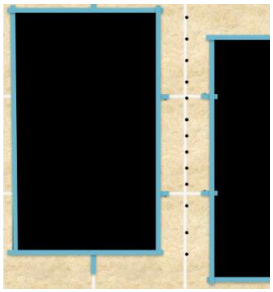


To get air down to where the water is at we are going to drill holes down through the grout lines to the subfloor. Drill through the concrete board but not all the way through the subfloor. By doing this every two inches in all the affected areas we will create a path for to air flow where the water is at. Using a negative pressure floor drying system and mats we can draw air through the holes that we have drilled.

Proper Drying Process

1. Inspect for moisture. Create a drying chamber in the area below the ceramic tile.

2. If walls are wet, do they have a non permeable wall covering? (wallpaper, several coats of paint, semi-gloss paint, lead based paint, etc.)



a. Yes- Remove baseboards, cut a 2" strip off the bottom of the drywall to allow drying from the back of the drywall.

a. No-Go to Step 3.

3. Check for a moisture barrier such as vinyl floor under the ceramic or stone floor.

4. Using a 1/8” masonry drill bit drill holes every two inches in the grout lines in the affected areas. Mark Drilling depth with tape. Vacuum floors to remove dust.

5. Apply antimicrobial to the affected floors and walls.

6. Tape down panels over the floors. Tape all grout lines first, working the tape down into the grout line. Then go all the way around the panels sealing them to the floor. Attach to the vacuum system.

7. Choose drying process:

a. Conventional - Use Class 4 divisor to determine initial dehumidification needs. EP should be 2.5 minimum but it is preferred that EP be close to 7. It is important to get the floor warm. Use only the dehumidifier to inflate the plastic containment, not an air mover. You may need to add air movers to create some air movement around the perimeter if using a small dehumidifier with low air flow.

b. Directed Heat Drying - Use one ETES or TEX box per room up to 200 square feet. EP should be 7 or better. Use TES equipment to inflate the plastic containment. Set up thermostatically controlled ventilation or dehumidification to control humidity.

8. After installing plastic containment, sandbags and drying equipment, is plastic floating through the entire wet area?

a. Yes- Go to Step 9.

b. No- Make sure to remove large wrinkles from plastic. If plastic still won't float, turn up air mover in ETES or if using dehumidifier limit air escape from edges of plastic by adding sand bags.

9. Do a final check of all connections to be sure that no negative pressure vacuum system hoses were knocked loose from the mats during installation of the other equipment and the containment.

10. Install pairs of screws from below through the subfloor and up to the cement board.

11. Using an invasive meter, touch the pins to the screw sets to determine moisture content. Continue drying until goals are achieved.

Once floors are dry, the entire continuous tile area must be re-grouted.

3.6.1 - Drying Around Cabinets

Trying around cabinets is a challenge because the cabinets prevent us from getting to the water easily. Not getting to the water is a problem because cabinets are often in food preparation areas and this is definitely not where we want amplified mold or bacteria. Many of the common techniques for drying around cabinets are not effective because they don't address all the areas that are wet. We need a very effective and repeatable solution that can be used in any situation.

There are two main objectives that we must accomplish with any cabinet drying solution.

1. Get hot dry airflow to all of the wet areas,
2. Take moisture readings to ensure that we completely dry the wet areas.

Drilling Holes In The Toe Kick Is Not Sufficient

The most common technique I see for drying around cabinets is drilling holes in the toe kick and injecting air into the holes. This is not sufficient because it does not dry the drywall and cavities behind the cabinet number one and number two does not allow any access for us to be able to determine whether not we completely dry the wet areas. Don't do this anymore.

Proper Drying Process

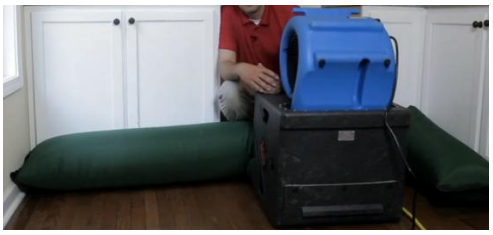
1. In order to properly dry around cabinets remove the toe kick. By removing the toe kick we open up the space underneath the cabinet and we also get access to the back of the cabinet. This is going to make it possible for us to dry the interstitial cavities behind the cabinets.

2. Once the toe kick has been removed, using a drill with a boring bit, drill through the back of the cabinet and into the wall to open up the cavity for drying.

3. Install drying equipment to force hot dry air flow to the water.

4. To take readings on the wet areas install screws through the back of the cabinet and into the drywall and framing so that complete readings can be taken.

We have accomplished the two objectives getting hot dry air flow to the water and being able to take moisture readings at the wet areas in this simple 4 step process.



3.7.1 Drying Unfinished Areas

(This process flow addresses commonly found issues but a thorough inspection is required. Use professional judgment to adjust process to each individual situation.)

1. Have you done a full inspection of the perimeter to identify all wet areas? (ie. Basement, crawlspace, etc.)
    a. Yes- Establish drying in those areas as needed.
    b. No- Extract and go to step 2.

2. Is the entire continuous area affected by water?
    a. Yes- Go to step 3.
    b. No- Install containment around the wet area.

3. Apply antimicrobial to the affected floors and walls.

4. Install dehumidifiers per initial guidelines. (*Cubic footage of the affected area/100= pints of dehumidification*)

5. Install air movers every 10-16 linear feet along walls at the appropriate angle making sure that there is airflow on all wet surfaces. Install additional air movers as necessary to get air movement on the floor if rooms are large.

6. Establish temperature control to create more than 1.5 EP. If possible increase material temperature to get 3.5 EP in unfinished areas to speed the drying process.

7. During monitoring visits check to make sure that EP has met the established goal and that moisture readings are progressing satisfactorily.

3.8.1 Drying Vinyl and Laminate Flooring

Since we see a lot of vinyl and laminate flooring in the homes that we dry we need to understand whether these type of floors should be dried. And the question must include 'should they be dried' not just 'can they be dried.' We need to consider the cost of drying versus replacement and whether not the material can be restored to a pre-loss condition.

Laminate Flooring

The interest in drying laminate floors comes from it having the potential to be a fairly costly material and that it is often used in large sections of the home. It represents a high replacement value.

Can we develop a drying system that will dry laminate floors? As with drying any material we must be able to get hot, dry, airflow to the water. There is a moisture barrier installed between the subfloor and the laminate material that will trap water away from our drying system. This makes it impossible to dry without removing the moisture barrier which means removing the floor. We cannot dry laminate flooring in place.

Can the floor be restored? The problem is that laminate flooring is a pressed wood product that irreparably swells when it gets wet. This added to the inability to dry clearly shows laminate flooring cannot be restored.

Vinyl Flooring

Vinyl flooring is a moisture barrier, so drying through vinyl flooring is not possible. In most cases vinyl that has gotten wet must be removed to allow drying. When water has gotten more than a couple inches under the vinyl it must be removed.

In a very few situations where the area that has gotten wet is very small ***and*** just at the edge of the vinyl, ***and*** the continuous area of vinyl is very large ***it may*** be cost effective to dry the vinyl floor. In those cases, remove the trim to expose the edge of the subfloor and apply hot, dry, airflow to the affected area. Understand that this drying is slow and costly so prepare both the adjuster and homeowner. No additional restoration is needed.

3.9.1 Category 3 Water Loss Response Principles

Category 3 water losses present additional challenges due to the contamination that is present. The water loss is defined as Category 3 because of gross contamination due to mold, bacteria, pathogens or other substances that are harmful to humans.

Along with the water that is in the structure we also must address the contaminates. The S500 points out that fact. When contaminates are found on a water loss we must make efforts to contain and clean the structure as part of the water damage processes. There are a few principles that are key to proper response.

1. *Contain the contaminated area.*
   Put up containment barriers around the affected area. Establish negative containment to prevent the spread of contaminates to other areas of the structure. Seal all openings to other areas of the structure including HVAC vents.

2. *Decontaminate the affected areas.*
   Remove all highly porous materials that are affected by the contaminated water. Remove multiple layers of materials so that a single layer of materials is left to allow access for complete cleaning. Thoroughly clean surfaces to remove as much of the contaminates as is reasonably possible. Apply an antimicrobial to sanitize the clean surfaces. It is best to test the contamination level of surfaces to verify the effectiveness of the decontamination process.

3. *Dry the structure.*
   Following decontamination the structure is clean, but wet. Follow normal drying procedures to complete the drying of the structure.

3.9.2 Category 3 Water Loss - Contaminated Material Removal

When working in a grossly contaminated environment it is critical that all areas be decontaminated. This will include removal of some of the materials in the structure. There are two primary situations that will require removal of materials:

1. All materials considered highly porous must be removed from the structure. They cannot be cleaned because they have absorbed bacteria and contaminates into them and decontamination of those materials is not effective. This is why they must be removed. Examples of highly porous materials would include things like carpet, pad and drywall.

2. Pockets of saturation are formed when multiple materials are stacked on one another. This traps the contaminates and makes removal through cleaning impossible. For example when hard wood flooring is affected by Category 3 water it is impossible to clean between the finish floor and the sub floor. Removal of the hardwood is necessary. It is not necessary to remove base plate framing from the floor. High pressure spray can be directed under the plate to rinse the area clean.

All materials that must be removed should be taken out in a professional manner. Cuts should be measured and chalked. (*See 3.1.1 Removal of drywall and trim for more information.)*

It is necessary to bag all materials and seal bags to prevent contamination from being spread into areas that were unaffected. The path from the work area to the exterior should be covered with plastic to catch any drips if the bags are leaking.

3.9.3 Category 3 Water Loss - Decontamination

Once the affected materials have been removed from the structure, decontamination reduces the amount of contaminates left in the structure. Decontamination consists of two primary steps:

Cleaning
Application of a disinfectant

Cleaning must be thorough. The surfaces that you are cleaning should be visibly clean. There are many different ways this could be accomplished. Mopping, wet washing and pressure cleaning are the most common cleaning methods used. Pressure cleaning is the most effective and fastest way to remove contaminates.

Vacuum or sweep debris from the work area. Use a nozzle from the pressure cleaning system to blast debris and contaminates off of building materials paying special attention to corners and sill plates where debris will collect. Follow that with cleaning of the floors with a high pressure wash/vacuum wand to rinse contaminates away. Do not rush this step. Be very thorough with the cleaning process and don't leave puddles of water standing or the disinfectant that you apply will be watered down and may lose effectiveness.

When cleaning has been completed application of a disinfectant is necessary. Follow the directions on the bottle for proper application. Pay attention to the application rate, any mixing instructions and dwell time. It is important that disinfectants are applied exactly as recommended in order for them to be safe and effective.

It is recommended that you test the effectiveness of your decontamination process with ATP testing. This gives you immediate results on microbial contaminate levels. If contaminate levels are at a 'pass' level, proceed with drying. If a 'fail' level is achieved repeat decontamination processes until a 'pass' result is achieved and record that result using either a photograph or the data logging capabilities of the meter you are using.

It is also important to decontaminate areas around the affected areas. The occupants have likely tracked contaminates on the flooring around the affected area. Application of a disinfectant and hot water extraction would be appropriate for carpeted areas. Use of a disinfectant and thorough mopping may suffice for hard surfaces.

Continue to operate the negative air machines during the drying process. This will affect dehumidification and temperature in the structure. Resizing of dehumidification equipment will be required due to the air exchange created by the negative air equipment. Other than that normal drying processes may be used for drying the structure after it has been decontaminated.

3.9.4 Category 3 Water Loss Process Flow

(This process flow is a guideline that addresses commonly found issues but a thorough inspection is required. Job complexities will require that you provide additional services. Use professional judgment to adjust processes to each individual situation.)

4. Protect yourself by wearing appropriate PPE. Protect the occupants by keeping them out of the affected areas.

5. Prior to entering the affected area, lay down plastic between the entry of the building and the affected area to prevent cross contamination by tracking liquids.

6. Identify the affected area and establish containment of that area.
   - Install containment barriers.
   - Setup negative air machines to put the affected area under negative containment.

7. Extract excess water.

8. Remove highly porous items such as drywall, insulation and carpet that are affected.

9. Remove materials that are trapping contaminates such as multiple layers of flooring or wallboard.

10. Bag and dispose of debris properly.

11. Thoroughly clean subfloor and walls with pressure cleaning or similarly effective cleaning process. Surfaces should be visibly clean.

12. Apply antimicrobial to affected areas, including areas where contamination was likely tracked by occupants, according to label directions.

13. Test the effectiveness of decontamination efforts.

14. When testing is passed proceed with appropriate drying processes.

3.10.1 Concrete Drying

When it comes to drying concrete your tools are the same as with all drying projects, Evaporation Potential, airflow and patience. You are just going to need a lot of each for concrete.

Drying Time

It is impossible to rush concrete drying and it is very difficult to determine how long it will take to dry so don't make promises. There are 3 things that will affect drying time on concrete:

15. Vapor Barrier - Prior to beginning concrete drying be sure there is a vapor barrier in place under the concrete. It may be that there are blueprints that specify this and current building codes require one, but if you are not sure coring may be required to confirm the presence of a vapor barrier. Without a vapor barrier it is unlikely that you will ever dry the slab to a moisture content that is acceptable.
16. Duration of water exposure - The longer concrete is wet, the longer it will take to dry.
17. Plasticizers - If plasticizers have been added it will extend the drying time of the concrete.

Drying Principles

To dry concrete you must have a high EP or large vapor pressure differentials. It is best to have an EP between 5 and 7. This means that the concrete must be warm to increase water vapor pressure. The air must have a low vapor pressure (dry air).

Concrete requires substantial heat to raise its temperature and therefore its moisture vapor pressure. In order to heat the slab you need air flow and containment to hold the heat to the slab. ETES units are particularly well suited for drying concrete as they are very safe and are designed to float plastic with substantial air flow. A hydronic TES unit can also be used but the continuous need for propane over a long period of time should be considered.

Drying Process

Install plastic containment over the concrete, weighting it down around the perimeter with sandbags.
Inflate the containment with Etes units or another heating or dehumidification system that can provide substantial airflow.
Monitor drying progress.

3.10.2 Taking Moisture Readings In Concrete

Any time a concrete floor gets wet and a finish floor will be glued directly to the concrete, the moisture content in that concrete must be established. If there is too much moisture in the concrete the installation of the finish floor may fail. For this reason flooring manufacturers set a concrete moisture content specification for warranted installation of their flooring. Moisture goals on some jobs may also be set by an engineer. A water restoration professional needs to understand the tests to be taken.

There are very specific processes by which moisture readings have to be taken in concrete. Even following these processes exactly will result in inconsistent results. Knowing that, it is not recommended that you are the one to certify a concrete floor dry if finish floor is to be installed over it. As a restoration professional you will determine if moisture is elevated initially, take progressive readings during drying and give direction when you believe final testing should be done. Then let someone else take the responsibility for saying the concrete is dry: usually the flooring installation professional.

Electronic Concrete Moisture Meter

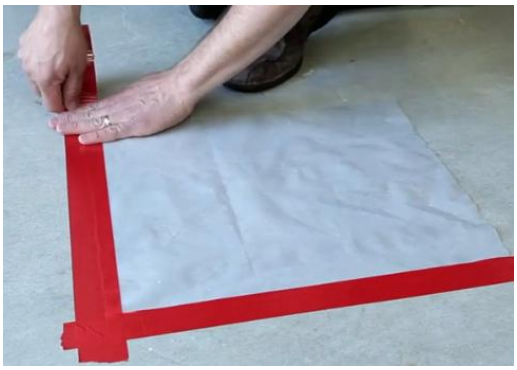
These can be used for surveying concrete to determine the extent of moisture intrusion, but will not provide a reading that is accepted by flooring manufacturers. This does not replace relative humidity testing since it does not provide a moisture content reading.

Plastic Sheet Test (ASTM Standard D4263):

Tape an 18” square of polyethylene sheet onto the concrete surface

Allow the sheet to remain attached and undisturbed for at least 16 hours

Look at the concrete and the plastic. If there is moisture on the plastic or the concrete is noticeably darker flooring should not be installed.



Relative Humidity Probe (ASTM Standard F2170):

This test will give you an Equilibrium Moisture Content (ERH) reading of the concrete. This is valuable because the finish floor manufacturer will have established an ERH specification for installation. The ERH reading is found on the relative humidity reading of the hygrometer.

Most of the slabs that you will dry can only be dried from one side because they are on the ground or metal deck. If that is the case you need to drill 40% of the depth of the slab to take your reading.

If you can dry from both sides only drill 20% of the depth of the slab.

From here you must follow the directions of the meter that you are using for proper use of the sensing equipment, but the ASTM standard requires that the room and floor be at normal service conditions for 48 hours before performing the test. This means that drying must cease and the slab must return to a ‘normal’ temperature in order for the moisture readings to be accurate.

4.1.1 The First Impression

The Experience Account

The Experience Account is just like a checking account. Good moments in the experience add to your balance and negative moments take away from the experience account balance. In most cases we start at a negative balance due to bad experiences with other service related businesses. As the 'face' of the company, each technician must work to build the experience account balance for the entire company.

The First Impression

People will make a decision about you in the first few seconds after having met you. That First Impression must be designed to produce a positive result. With that in mind always follow the 'SELECT' steps.

'SELECT' Steps

Stop a couple of miles from the job site and pull off in a safe location.

End any phone conversations before arriving at the job.

Look in the mirror.

Everything needed to go to the door is at hand. (Job File, meters, camera, etc.)

Check your uniform, tuck in your shirt, dust off any crumbs, check your shoes.

Timely arrival. If you are going to be even a few minutes late, call in advance to correct the arrival time.

Arriving At The Home

Upon arriving at the home, immediately get out of the vehicle and head to the door.

Ring the doorbell and step back a couple of steps, but remain facing the door.

Smile and greet the customer kindly.

By following these steps you can make a deposit into the experience account even before you speak. Conversely, it is nearly impossible to completely eliminate a negative first impression.

4.1.2 Building Trust Is A Worthy Investment

Defining Trust

Trust - An assured reliance on the character, ability, strength or truth of someone or something.

Trust can be placed in an individual or a company. It is hard to create and easy to break. There are no tricks to earning trust. There are principles and activities that will helps us to build trust. Below are a few examples of the principles of character, ability, strength and truth.

Character

Trust the customer. If you believe that all customers are not to be trusted, they will sense this and be distrustful of you also. Your actions will also show your lack of trust in them. Start by assuming all customers are trustworthy and you will find that the vast majority are.

Communicate and listen. Make eye contact and listen carefully to everything the customer says. Respond professionally and in a kind manner.

Show respect for the customer (ie. be on time) and their property and belongings (don't set tools on counters or furniture).

Ability

Certification goes a long way in telling someone that you have the ability to accomplish the work you have been hired for.

Answer questions that they may have briefly but clearly. Make sure that they understand what you are going to do in their property, but don't be a know it all.

Keep your work environment clean. Often the greatest impression made on an individual is how clean your workspace is. Since most people don't know much about water restoration, they have few other ways to judge your ability.

Strength

Exceed the customer's expectations. For the extra mile when you can for no other reason other than to be helpful to the customer.

Handle customer complaints immediately. Take ownership of them and make sure that there is a resolution brought to the issue. Even if the issue doesn't involve you, you are the face of your company.

Truth

Obviously don't lie. Don't purposely omit details either.

Do what you say you are going to do. If you don't people perceive that as lying.

Follow through on things like being on time. This speaks to the truthfulness of what you say.

4.2.1 Why Customers Get Upset And Why You're Likely The Problem

When you deal with customers on a regular basis you are going to have issues come up. Customers not happy with your service. Your frustration can compound when despite your best efforts to help, customers seem as though they don't want to be helped.

Who Are These People?

They can act rude, bossy, picky, difficult and downright crazy. Actually customers are just regular people like you that want their needs taken care of. Likely you have been an unhappy customer. Your needs were not met. Were you justified in being unhappy? Likely you would say that you were. With that in mind we must check our attitude toward customers when they are not happy.

The Natural Response

When someone gets upset with us due to the service that we have provided we respond in two ways that turn issues into difficult problems:

1. We defend ourselves and others in our company.
2. Identify the customer as the problem.

When you react in this way it becomes very difficult to resolve the issue. Instead you get into a mode of justification of your own actions and focusing on the problem instead of the solution. If you find that many customers are difficult to deal with, you are the common element in each situation and likely you and your thinking are the problem.

Customer Experience Goal

Keep in mind our goal: 'Do whatever it takes to get the check!' No this is NOT our goal. That is a bad thought process to start.

Our real goal is: 'Leave Every Customer Wanting To Refer Friends and Family.'

DO NOT:

Rehash Details Of The Problem

Defend Yourself Assuming The Customer Is At Fault

Position Yourself in Opposition To the Customer

Reduce Your Goal To Just Getting The Check

DO:

Focus On Our Goal

Focus On Solutions

Listen To The Customer

View Customer Issues As Legitimate

4.2.2 Be Solution Oriented Not Problem Oriented

Customers are going to have valid issues. Even though they may get irritated, they are just normal people who want their properties fixed properly. Keep in mind that even when issues come up our objective is *still* to leave them wanting to refer us to friends and family.

When we keep this as our objective in every case and execute accordingly, we often can turn a customer who has brought up an issue into a more loyal customer than one who never had a problem to begin with.

Why Think 'Solutions' Instead of 'Problems'?

You will never win an argument with a customer. No one in the history of customer service has ever won an argument with their customer. Arguing is a symptom of a focus on the problem at hand instead of a solution. It is flawed thinking to believe that we need to defend our position, first establishing that we weren't wrong before proceeding with a solution.

Proper thinking is to immediately begin focusing on a solution. That is the purpose of the customer approaching you in the first place. They are never interested in finding out what caused the problem, they just want it to go away. That is what you want as well. You want the problems gone. So focus on the solution instead of the problem.

Contrast Solution and Problem Focused Thinking

Problem Oriented	**Solution Oriented**
Customers are Problems	Customers have legitimate issues
Complaints are negative	Complaints are an opportunity for improvement
Who's wrong here	How can I help this customer?
What's the Problem?	What's the solution?
Avoid customers calls	Be prompt and direct in delivering solutions

Note that problem oriented thinking takes you away from the objective of finding a solution. It is negative. Unfortunately, this is the natural response since our customer is bringing a problem to us.

Contain The Issue

Contain problems within your organization. This means not allowing the customer to escalate issues to parties outside your organization. When issues are contained within your organization they are much simpler and easier to resolve. When an additional party is involved complexity will be added.

People feel the need to escalate issues when they feel a lack of confidence that a problem will be resolved, perceive a lack of concern on the part of the representative or if it is not being handled in a timely way. Sometimes this occurs despite your best efforts. There are two things that successful companies do to contain and resolve issues:

1. Verbally explain to the customer that since you know the most about their claim, you are in the best position to address any questions they may have. Additionally state that you will work to quickly resolve all issues that arise in connection with the restoration of their property. And then do it!
2. Give them an issue escalation plan. You must develop confidence in the customer that you can and will successfully restore their property. If you are finding that customers regularly call their adjuster or agent instead of calling you, they lack confidence in you.

A written escalation plan is extremely successful in keeping issues within your organization. As an example, the escalation plan could arrive as a letter addressed to the individual from the owner or principles in the organization. The letter welcomes them as a customer, thanks them for trusting you with their property and assures them of the interest you have in seeing their property fully restored. Then the owner gives his or her cell phone number and email address and expressly states that if there are any issues that arise that are not being handled as expected, they should please contact the owner immediately 24 hours a day and he or she will make sure that they are immediately fixed.

By giving the customer a way to escalate things within your organization you will have much greater success in containing issues. When issues are contained you have a much greater chance of creating loyal customers that want to refer you to friends and family members.

4.2.3 - Own The Solution

When a customer approaches you with an issue, it is your responsibility to see that issue to resolution. It is all too easy to just say you had nothing to do with the issue and forward them on to someone else, but this is very frustrating for the customer. You must Own The Solution!

When resolving issues there are often emotions involved. Since it is difficult to overcome an issue when someone is very upset our first objective is to help calm the situation. Once the situation is calmed down, then quickly offer a solution that is agreeable to the customer.

In the process of being faced with this volatile situation we have to be careful not to get over taken by our own emotions, becoming angry or frustrated. Keep in mind that this is not personal. Don't allow it to become personal. One technique that is successful in keeping our emotions in check is to have a clear process for issue resolution.

Solutions Process

A simple acronym for remembering this process is WALRAS. Sounds like 'walrus' but spelled differently.

When an issue arises...

Apologize immediately to calm the situation. Ask kindly the person to carefully explain the situation.

Listen intently without interrupting. Let them vent. Do not attempt correct them on any points.

Repeat the specifics of the issue as you understand them. You must understand the issue before you attempt to create a solution. Be careful not to sound doubtful or questioning in any way. You just want to make sure you understand the issue.

Apologize again with the problem in mind. It is good to include a specific or two that you just agreed upon in the apology.

Solve the problem. If a solution is obvious and you are authorized to offer that solution, do so immediately. If a solution is not readily apparent ask what they believe to be an acceptable solution. If after attempting you cannot solve the problem set a specific time later *that same day* to call them back with a proposed solution.

Follow Up

It is important to follow up after a solution has been agreed upon. Once the solution is put into effect we need to be sure that it has solved the issue. It is necessary to schedule yourself a phone call or visit the day of, or at most a day or two after the solution is put in place.

The purpose of this call is to be sure that we are achieving our objective of developing a loyal customer. If the individual is happy with our solution, ask if at this point they would feel comfortable referring us to friends and family members. If yes, we have been successful. If not, determine why not. Start over with the solutions process above.

Thank them for bringing the issue to you and let them know that you are available if any other issue were to arise.

Emails

Never respond to a customer issue by way of an email! It may seem like a quick easy way to move forward, but issue resolution is often emotional. Emotion cannot be properly conveyed by email. You may write a note in a kind manner, but because the customer is upset they read frustration into your email that was never intended and it can make the situation worse.

Email may be used after the situation is under control and a solution is obvious. Minor details at this point may be conveyed by email.

Be Proactive

Think of ways to WOW the customer. Exceed their expectations. Be friendly, respectful and considerate of the customer and their property and you will likely avoid issues or at the least make them easier to solve.

When you notice a change in the demeanor of the customer, approach them and ask them how you can help even if they haven't addressed an issue.

This type of proactive, solutions-oriented approach will make issues rare and easy to repair when necessary.

4.3.1 - Customer Satisfaction Is Not Enough

Satisfaction is a take it or leave it response from a customer. When you are satisfied with something, it works but is nothing special. There is no reason not to choose someone else if it is convenient. Customer satisfaction is not enough!

Customer loyalty is our goal. It is the degree to which customers will patronize your business and your business alone because you've developed or created an emotional bond with them. You've gone beyond their expectations and addressed their emotional needs as a consumer.

Customers have come to expect fast, friendly service. They expect to get an answer to their questions. They expect you'll answer their call promptly and return their messages. Do those things well and you'll be in the game. But will you win their loyalty? Not necessarily. If you fail, have you lost them forever? Again, not necessarily.

Research shows customers are willing to accept some failure in terms of these expectations. Fail continuously and that's a different story. This is where many companies and their representatives fall short. They believe that a satisfied customer is a success. But the next time a customer that is merely satisfied needs your product or service they may, if it's convenient, patronize your business. But they won't seek out your business purposefully. To do that, they must be blown away by your service. They must be so impressed with your service that they become a dedicated follower.

We have really four different levels of response to customer service:
1. Angry
2. Dissatisfied
3. Satisfied
4. Thrilled

Satisfied or Dissatisfied

Dissatisfied and satisfied customers both are somewhat unmotivated in either direction. The dissatisfied customer if asked would potentially give you another shot but was not satisfied based on the last experience. They may feel as though the value of your service did not meet the amount paid. Satisfied customers feel that the service was what they paid for. You did what you were supposed to do. Unfortunately they will often forget you as quickly as the work is complete. They will rarely if ever refer you. They are just as likely as not to choose someone else next time.

Let me give you an example of satisfied and dissatisfied customers. You go to a gas station and fill up your tank. Pay at the pump is not working. You go to the window and the clerk is not friendly. You are obviously dissatisfied, but will you drive across town to avoid this station. Probably not.

You go to another gas station and fill up your tank. Pay at the pump is working. You are out quickly and on your way. You are satisfied. You got what you paid for. The next time you need fuel are you going to drive across town to get fuel there. No. Unfortunately this level of service is not enough to motivate any real response in the customer at all.

Angry or Thrilled

What about the extremes? Angry and thrilled customers. These are customers that have an emotional reaction to our services. They are motivated by those emotions to take action.

Angry customers will not use your service again. This is a person that you have so greatly offended that they will do anything to sabotage your business. They may fire you in the middle of the job. They will tell many people about the negative experience. They will write letters and post reviews and as they do they will embellish the story. They are terrorists set on damaging your company. This will create a tremendous amount of problems and draws down everyone involved.

Thrilled customers are the other end of the spectrum. They are the raving fans, the cheerleaders of your company. They will come back to you with little regard for price. They will refer your company to other people. They will go out of their way to help you to succeed. They also write letters and post reviews and embellish the story, but in this case to help you. They have been thrilled by the experience they had.

In both cases there was an emotional reaction to the experience had. These are primarily formed due to you either exceeding or stomping on the emotional needs that the customer had during the process.

Achieving Our Goal

Meeting our goal requires that we make creating loyal customers our mindset. There is a big difference between satisfied and loyal customers. We want customers that are blown away by our service, surprised by the high level of concern and care taken as their service needs were filled.

4.4.1 Listening To Customers

If there is one thing that can cause the failure of a relationship it is a lack of communication. Not just talking, communicating.

One definition of communication is *the successful conveying of ideas*. That means that both parties speak and listen. Some things are spoken and others unspoken. Listening is a critical component. Listening means to take notice of *and* act on what someone says. Someone who listens acts upon what they have heard. Conversely, inaction indicates not listening.

There are two things in particular that you should listen for:

1. Specific information related to the work at hand.
2. What component of project management is most important to the customer.

Listen for Specific Direction

When listening to specifics, listen to both what is said and what is not said. For example, the customer may state that they do or don't want flooring removed. Comply with what is requested as long as it is possible to do so.

The customer needs work to take place during specific hours. Comply by only scheduling during those hours.

If the request is that employees only work when the property owner is at the home, then respectfully comply. Read between the lines and understand they are concerned about your integrity and their security, so it would be smart to be very security conscious and build trust.

If security is of utmost importance there are a few standard actions that you should take. Do not ask to be at the home when they are not. Ask before entering a room you have not already been shown by the homeowner. Be sure that the customer always knows where you are in the house. Give them a list of their personal property items that must be transported to another location. Do not ask for a key to the home.

A particular piece of furniture is identified as from a relative. Immediately stop and take precautions related to that furniture. Block and tab, or remove it from the wet area.

The customer notes that a piece of furniture is very expensive. Acknowledge concern for the item or finish material. Mention what you are going to do to protect or restore the item or finish. If there is debris on the furniture, it may be good to immediately remove some of that. Obviously don't joke about damage.

4.4.2 Communication Plan

Communication does not occur by accident. It must be planned. There are two elements of communication that must be planned.

1. Preferred method of contact.
2. When to communicate.

Preferred Contact Methods
This is going to vary by customer. Determine how the customer prefers to be contacted: by phone, email or text. This is the preferred method of contact. Most prefer phone calls, but some customers may not be able to take calls during work and one of the other methods is preferred. Even though phone is preferred for most communication it should be recapped with written communication.

From a company standpoint get as much in writing as possible. If communication isn't written it didn't happen. There are two primary options for written communication and one must be selected: text or email. In the case that there is a misunderstanding you can refer to written communications.

When to Communicate

In short term projects there are 3 communication points that must be planned:

1. Kick off
2. Outbound interim
3. Project closeout

Kick off at a minimum communicates the goals of the project (includes scope, timetable and finished product) and specific actions that must be taken. Most companies are doing this because it is usually completed of necessity.

Outbound interim is the most common failure point *and* the greatest opportunity for success or greatest exposure for failure. On mitigation projects communicate daily with the customer when monitoring is done. For construction projects when you set specific days each week to call the client your chances for success increase dramatically. Companies that fail to plan outbound communication are characterized by inbound customer calls that are adversarial, angry or aggressive.

They also usually don't contain issues, but see them escalated to other parties like agents or adjusters. That makes issues even more difficult to correct. When *you* call the customer any concerns they have are not already at a boiling point and they are usually willing to work through any potential issues.

Project closeout documents achievement of the goals set at the project kick off meeting.
Usually Certificate of Satisfaction or Completion documents are signed.

Without a plan communication is driven by the emotion of the moment and all too often that is negative or adversarial. When planned, communication is part of the project objectives. It is logical and cooperative. If customer loyalty is your goal, plan to communicate with your customers.

Evaporation Potential Chart

See reverse for expanded view

GPP	6	10	16	24	36	44	53	64	77	92	110	118	127	136	145	156	166	178	190	203	217
DP	0	10	20	30	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90
32	0.5	0.4	0.2	0.0	-0.2	-0.4	-0.6	-0.9	-1.2	-1.5	-1.9	-2.1	-2.3	-2.5	-2.7	-2.9	-3.1	-3.4	-3.6	-3.9	-4.2
40	0.7	0.6	0.5	0.3	0.0	-0.2	-0.4	-0.6	-0.9	-1.3	-1.7	-1.8	-2.0	-2.2	-2.4	-2.7	-2.9	-3.1	-3.4	-3.7	-4.0
45	0.9	0.8	0.6	0.5	0.2	0.0	-0.2	-0.5	-0.7	-1.1	-1.5	-1.7	-1.8	-2.0	-2.3	-2.5	-2.7	-3.0	-3.2	-3.5	-3.8
50	1.1	1.0	0.9	0.7	0.4	0.2	0.0	-0.2	-0.5	-0.9	-1.3	-1.5	-1.6	-1.8	-2.0	-2.3	-2.5	-2.8	-3.0	-3.3	-3.6
55	1.3	1.2	1.1	0.9	0.6	0.5	0.2	0.0	-0.3	-0.6	-1.0	-1.2	-1.4	-1.6	-1.8	-2.0	-2.3	-2.5	-2.8	-3.0	-3.3
60	1.6	1.5	1.4	1.2	0.9	0.7	0.5	0.3	0.0	-0.3	-0.7	-0.9	-1.1	-1.3	-1.5	-1.7	-2.0	-2.2	-2.5	-2.8	-3.0
65	2.0	1.9	1.7	1.5	1.3	1.1	0.9	0.6	0.3	0.0	-0.4	-0.6	-0.8	-1.0	-1.2	-1.4	-1.6	-1.9	-2.1	-2.4	-2.7
70	2.4	2.3	2.1	1.9	1.7	1.5	1.3	1.0	0.7	0.4	0.0	-0.2	-0.4	-0.6	-0.8	-1.0	-1.2	-1.5	-1.7	-2.0	-2.3
72	2.5	2.4	2.3	2.1	1.8	1.7	1.5	1.2	0.9	0.6	0.2	0.0	-0.2	-0.4	-0.6	-0.8	-1.1	-1.3	-1.6	-1.8	-2.1
74	2.7	2.6	2.5	2.3	2.0	1.8	1.6	1.4	1.1	0.8	0.4	0.2	0.0	-0.2	-0.4	-0.6	-0.9	-1.1	-1.4	-1.7	-1.9
76	2.9	2.8	2.7	2.5	2.2	2.0	1.8	1.6	1.3	1.0	0.6	0.4	0.2	0.0	-0.2	-0.4	-0.7	-0.9	-1.2	-1.5	-1.8
78	3.1	3.0	2.9	2.7	2.4	2.3	2.0	1.8	1.5	1.2	0.8	0.6	0.4	0.2	0.0	-0.2	-0.5	-0.7	-1.0	-1.2	-1.5
80	3.4	3.3	3.1	2.9	2.7	2.5	2.3	2.0	1.7	1.4	1.0	0.8	0.6	0.4	0.2	0.0	-0.2	-0.5	-0.7	-1.0	-1.3
82	3.6	3.5	3.4	3.2	2.9	2.7	2.5	2.3	2.0	1.6	1.2	1.1	0.9	0.7	0.5	0.2	0.0	-0.2	-0.5	-0.8	-1.1
84	3.8	3.7	3.6	3.4	3.1	3.0	2.8	2.5	2.2	1.9	1.5	1.3	1.1	0.9	0.7	0.5	0.2	0.0	-0.3	-0.5	-0.8
86	4.1	4.0	3.9	3.7	3.4	3.2	3.0	2.8	2.5	2.1	1.7	1.6	1.4	1.2	1.0	0.7	0.5	0.3	0.0	-0.3	-0.6
88	4.4	4.3	4.1	4.0	3.7	3.5	3.3	3.0	2.8	2.4	2.0	1.8	1.7	1.5	1.2	1.0	0.8	0.5	0.3	0.0	-0.3
90	4.7	4.6	4.4	4.3	4.0	3.8	3.6	3.3	3.0	2.7	2.3	2.1	1.9	1.8	1.5	1.3	1.1	0.8	0.6	0.3	0.0
92	5.0	4.9	4.8	4.6	4.3	4.1	3.9	3.6	3.4	3.0	2.6	2.4	2.3	2.1	1.9	1.6	1.4	1.1	0.9	0.6	0.3
94	5.3	5.2	5.1	4.9	4.6	4.4	4.2	4.0	3.7	3.3	2.9	2.8	2.6	2.4	2.2	2.0	1.7	1.5	1.2	0.9	0.6
96	5.7	5.6	5.4	5.2	5.0	4.8	4.6	4.3	4.0	3.7	3.3	3.1	2.9	2.7	2.5	2.3	2.1	1.8	1.6	1.3	1.0
98	6.0	5.9	5.8	5.6	5.3	5.1	4.9	4.7	4.4	4.1	3.7	3.5	3.3	3.1	2.9	2.7	2.4	2.2	1.9	1.6	1.3
100	6.4	6.3	6.2	6.0	5.7	5.5	5.3	5.1	4.8	4.4	4.0	3.9	3.7	3.5	3.3	3.0	2.8	2.6	2.3	2.0	1.7
101	6.6	6.5	6.4	6.2	5.9	5.7	5.5	5.3	5.0	4.6	4.2	4.1	3.9	3.7	3.5	3.2	3.0	2.8	2.5	2.2	1.9
102	6.8	6.7	6.6	6.4	6.1	5.9	5.7	5.5	5.2	4.8	4.4	4.3	4.1	3.9	3.7	3.5	3.2	3.0	2.7	2.4	2.1
103	7.0	6.9	6.8	6.6	6.3	6.1	5.9	5.7	5.4	5.1	4.7	4.5	4.3	4.1	3.9	3.7	3.4	3.2	2.9	2.6	2.3
104	7.2	7.1	7.0	6.8	6.5	6.4	6.1	5.9	5.6	5.3	4.9	4.7	4.5	4.3	4.1	3.9	3.6	3.4	3.1	2.9	2.6
105	7.5	7.4	7.2	7.0	6.8	6.6	6.4	6.1	5.8	5.5	5.1	4.9	4.7	4.5	4.3	4.1	3.9	3.6	3.4	3.1	2.8
106	7.7	7.6	7.5	7.3	7.0	6.8	6.6	6.3	6.1	5.7	5.3	5.1	5.0	4.8	4.6	4.3	4.1	3.8	3.6	3.3	3.0
107	7.9	7.8	7.7	7.5	7.2	7.0	6.8	6.6	6.3	5.9	5.6	5.4	5.2	5.0	4.8	4.6	4.3	4.1	3.8	3.5	3.2
108	8.2	8.1	7.9	7.7	7.5	7.3	7.1	6.8	6.5	6.2	5.8	5.6	5.4	5.2	5.0	4.8	4.6	4.3	4.1	3.8	3.5
109	8.4	8.3	8.2	8.0	7.7	7.5	7.3	7.1	6.8	6.4	6.0	5.9	5.7	5.5	5.3	5.0	4.8	4.6	4.3	4.0	3.7
110	8.7	8.6	8.4	8.2	8.0	7.8	7.6	7.3	7.0	6.7	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.8	4.5	4.3	4.0
111	8.9	8.8	8.7	8.5	8.2	8.0	7.8	7.6	7.3	6.9	6.5	6.4	6.2	6.0	5.8	5.6	5.3	5.1	4.8	4.5	4.2
112	9.2	9.1	8.9	8.7	8.5	8.3	8.1	7.8	7.5	7.2	6.8	6.6	6.4	6.2	6.0	5.8	5.6	5.3	5.1	4.8	4.5
113	9.4	9.3	9.2	9.0	8.7	8.6	8.4	8.1	7.8	7.5	7.1	6.9	6.7	6.5	6.3	6.1	5.9	5.6	5.3	5.1	4.8
114	9.7	9.6	9.5	9.3	9.0	8.8	8.6	8.4	8.1	7.8	7.4	7.2	7.0	6.8	6.6	6.4	6.1	5.9	5.6	5.3	5.0
115	10.0	9.9	9.8	9.6	9.3	9.1	8.9	8.7	8.4	8.0	7.6	7.5	7.3	7.1	6.9	6.6	6.4	6.2	5.9	5.6	5.3
116	10.3	10.2	10.1	9.9	9.6	9.4	9.2	9.0	8.7	8.3	7.9	7.8	7.6	7.4	7.2	6.9	6.7	6.5	6.2	5.9	5.6
117	10.6	10.5	10.4	10.2	9.9	9.7	9.5	9.3	9.0	8.6	8.2	8.1	7.9	7.7	7.5	7.2	7.0	6.8	6.5	6.2	5.9
118	10.9	10.8	10.7	10.5	10.2	10.0	9.8	9.6	9.3	8.9	8.5	8.4	8.2	8.0	7.8	7.5	7.3	7.1	6.8	6.5	6.2
119	11.2	11.1	11.0	10.8	10.5	10.3	10.1	9.9	9.6	9.2	8.8	8.7	8.5	8.3	8.1	7.9	7.6	7.4	7.1	6.8	6.5
120	11.5	11.4	11.3	11.1	10.8	10.7	10.4	10.2	9.9	9.6	9.2	9.0	8.8	8.6	8.4	8.2	7.9	7.7	7.4	7.2	6.9
121	11.9	11.8	11.6	11.4	11.2	11.0	10.8	10.5	10.2	9.9	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.0	7.8	7.5	7.2
122	12.2	12.1	12.0	11.8	11.5	11.3	11.1	10.9	10.6	10.2	9.8	9.7	9.5	9.3	9.1	8.8	8.6	8.4	8.1	7.8	7.5
123	12.5	12.4	12.3	12.1	11.8	11.7	11.5	11.2	10.9	10.6	10.2	10.0	9.8	9.6	9.4	9.2	8.9	8.7	8.4	8.2	7.9
124	12.9	12.8	12.7	12.5	12.2	12.0	11.8	11.6	11.3	10.9	10.5	10.4	10.2	10.0	9.8	9.5	9.3	9.1	8.8	8.5	8.2
125	13.3	13.2	13.0	12.8	12.6	12.4	12.2	11.9	11.6	11.3	10.9	10.7	10.5	10.3	10.1	9.9	9.7	9.4	9.2	8.9	8.6

Surface Temperature

EP = S - A Evaporation Potential is the Surface Vapor Pressure minus the Air Vapor Pressure in **kPa**

Using your meters, find the **Surface Temperature** and the **Dew Point** or the **GPP** of the Air. Then, using the chart, find where those two numbers intersect to locate the Evaporation Potential (EP). The higher the EP, the better.

An EP of at least 7 is recommended for Direct containment.

An EP of at least 3.5 is recommended for Regional containment.

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